OUTCOMES OF TECH-PREP AND NON TECH-PREP GRADUATES IN

POSTSECONDARY TECHNICAL COLLEGE PROGRAMS

By

BRITTNEY WILSON

(Under the Direction of Jay W. Rojewski)

ABSTRACT

Major emphasis has been placed on tech-prep programs during the past decade. The most recent national evaluation of tech-prep programs, conducted in 2004, found data on tech-prep student outcomes to be positive. While students are better prepared for both college and the workplace, tech-prep has not been a widely effective strategy for improving student outcomes at the postsecondary level. If tech-prep programs are to maximize the preparation of students for both work and postsecondary education, it is imperative that postsecondary outcomes of high school students graduating from tech-prep programs be examined. Therefore, the purpose of this study was to examine the postsecondary outcomes of tech-prep graduates entering 2-year technical colleges directly from high school after two years of study at the technical college level. Specific measures of student outcomes included indicators of need for mathematics, reading, and writing remediation and successful completion rates from diploma, technical certificate, and Associate of Applied Science Programs.

Descriptive statistics were used to describe participants' gender, minority status, and type of college program pursued. A series of one-way analysis of variance (ANOVA) procedures were used to compare the two groups of students, tech-prep and non tech-prep. A chi-square test was used to measure successful completion rates.

The sample for this study was 173 high school graduates from 2002 and 2003 who entered Coosa Valley Technical College in the fall, winter, spring, or summer quarters during 2003. Completion status was determined as of December 2005 to give students sufficient time to complete a diploma, technical certificate, or Associates degree.

Of the 173 high school graduates in the study, 73% completed a tech-prep curriculum. Findings of the study suggest that a different high school curriculum does not necessarily better prepare students for entry into postsecondary education. Evidence suggests that tech-prep and non tech-prep students are prepared for technical college programs according to Asset test scores. In terms of successful completion rates, findings suggest that tech-prep and non tech-prep students pursing a diploma, technical certificate, or Associate of Applied Science are equally likely to successfully complete a program of study.

INDEX WORDS: Tech prep, Technical College, Asset test, Graduation rate, Postsecondary education, Perkins legislation, Career pathways

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INTRODUCTION

Introduction

In past decades, Americans with a solid work ethic and some work-related training could fare relatively well in the economy, even if they possessed low academic skills. Jobs requiring low- to medium-level skills were plentiful and most paid sufficient wages to support a family. However, the number of low-skilled positions in the U.S. is declining, and the fastest-growing jobs in the U.S. economy require some form of postsecondary education (D'Amico, 2003). For example, in the U.S. over 65% of all occupations now require advanced skill training beyond high school, but less than a 4-year baccalaureate degree. In addition, 90% of the fastest growing occupations require some career and technical education, many of these are health- or computer-related (U.S. Bureau of Labor Statistics, 2006).

By the year 2020, jobs that require postsecondary education are expected to increase by 22%, representing an estimated 12 million positions. A large portion of the people filling these positions will require additional education to support the needs of the new diversified workforce. In today's global economy, it is crucial that America's high school students have the sufficient basic skills in English, reading, math, and science, in addition to high-level thinking, reasoning, communication, and problem-solving skills. Employers estimate that 39% of high school students entering the labor market are unprepared for entry-level jobs and that almost 60% of jobs in today's workforce require postsecondary training. In Georgia, 40% of ninth grade students drop out of school. Also, about one-fourth of college freshmen drop out of school and one-half of community college students fail to complete a second year of school (Commission for a New Georgia, 2004). These numbers illustrate the fact that changes must be made at the high school level to encourage students to stay in school and obtain basic skills (2005 Education Summit on High Schools, 2005).

The shift in the labor market, from low- to high-level skills, has fueled educational reform efforts over the past three decades due, in part, to strong economic competition felt from around the globe. Recent changes in educational policy and practice can be traced back to the early 1980s with the *back-to-basics* movement. The landmark 1983 Carnegie report, *A Nation at Risk,* asserted that all graduating high school students must possess a certain level of basic academic skills in order to be successful. In response, curriculum reform began to emphasize academic education.

The resulting focus on academic education caused by commission reports like *A Nation at Risk* (Carnegie Foundation, 1983) resulted in career and technical education programs being devalued, de-emphasized, or even downsized in many schools. However, a highly academic, i.e., college-prep, curriculum is highly abstract in nature and does not meet the needs of a majority of students. In fact, 3 out of 4 students in the U.S. public education system are unlikely to ever earn a 4-year baccalaureate degree, but most schools and colleges operate under the assumption that they will (Parnell, 1994). Even so, there is a widespread belief that a four-year college degree is necessary to ensure economic success (Gray, 2002).

Parnell (1985), in his book *The Neglected Majority*, addressed the problem he saw with non-college bound students being neglected by public education reform. He described students being forced into a rigorous high school curriculum where they did not develop critical thinking skills, had no exposure to the labor force, and did not receive career or guidance counseling.

Parnell proposed a *tech-prep* curriculum to provide the neglected majority (i.e., the middle 50% of students) a bridge between high school academic skills and technical skills for employment. Parnell argued the need for career and technical education programs to better serve the middle quartiles of high school students in completing associate degrees, and stressed the importance of a solid foundation in academics in order for high school graduates to succeed beyond secondary school. Without this academic foundation, it was increasingly difficult for students to complete a college degree or enter into the workforce. Thus, the concept of the Tech-prep Associate Degree (TPAD) program was established (Craig, 1999).

In 1988, *The Forgotten Half* (William T. Grant Foundation) revealed that a majority of high school students lacked basic academic skills, as well as skills for life and work. This report acknowledged that not all students would go to college and that the challenge was to prepare all students for work and adult life. Little attention was given to enhancing the school-to-work transition of noncollege-bound students. The purpose of tech-prep was to combine high academic standards and technical training, ensure program articulation into higher education, and prepare students for high skilled technical occupations.

In 1990, Congress amended the Carl. D. Perkins Vocational Education Act of 1984 to allocate funding for tech-prep program development. Legislation required that funded programs include the following seven elements: (a) articulation agreements, the effective link between 2-year secondary schools and postsecondary schools; (b) a 2 + 2 design, with a common core of math, science, communication, and technology; (c) a tech-prep curriculum, enriched and applied instruction; (d) joint staff development for secondary and postsecondary faculty; (e) training to promote effective student recruitment, retention, and post-program placement; (f) measures to ensure access for special populations; and (g) preparatory services to include counseling and assessment. Section 343.(3) of the law states:

> The term *tech-prep education program* means “a combined secondary and postsecondary program that A) leads to an associate degree or two-year certificate; B) provides technical preparation in at least one field of engineering technology, applied science, mechanical, industrial or practical art or trade, or agriculture, health or business; C) builds student competence in mathematics, science, and communications (including through applied academics) through a sequential course of study; and D) leads to placement in employment.” (Hull & Parnell, 1991, p. 71)

The need for improved academic and technical coursework was recognized, employers were calling for improved *employability skills*. In 1990, the Secretary’s Commission on Achieving Necessary Skills (SCANS, 1991) was established to examine workforce demands. The resulting report, titled *What Work Requires of Schools: A SCANS Report for America 2000*, called for a third set of standards. In addition to academic and technical skills, employers needed workers who could think critically, use information and technology, work in teams, and solve problems (National Tech Prep Network, 2006). Schools and employers needed to work together to close the skills gap. Without the alignment of school and employers, the report predicted that many young people would leave school without the knowledge, skills, or foundation to find a good job (Hogg, 1999).

In 1994, the School-to-Work Opportunities Act was signed into law, which states that business, community agencies, and schools need to develop partnerships to better prepare students for the changing nature of work and employability. The School-to-Work (STW) legislation emphasized three foundations of development: school-based activities, work-based activities, and connecting activities. Also, in 1994 Goals 2000: Educate America Act, which promoted improved academic achievement among students, was signed into law. Goals 2000 consisted of five key elements including (a) a challenge to the nation based on eight specific, measurable education goals, (b) incentive funding to encourage comprehensive state and local planning, (c) accountability to measure progress and achievement, (d) target all children, and (e) emphasis on system wide reform. A major goal of Goals 2000 focused on the relationship between academic skills and productive employment, preparing all youth to pursue postsecondary education (Orr, 1998). Just as STW was an umbrella for initiatives such as tech-prep, Goals 2000 was an even larger umbrella that encompassed many school reform efforts (Paris, 1994). In 1999, Congress refused to reauthorize Goals 2000 (Superfine, 2005).

Tech-prep, which began in the early 1980s as an effort to improve secondary education for the middle half of students, has grown into a major national strategy to improve the academic skills and technical knowledge of high school students and to create a better educated and trained workforce. Tech-prep, as defined by the Carl D. Perkins Vocational and Applied Technology Education Act of 1990, focuses on preparing young people to transition directly into the workplace or into higher education upon graduation from high school. The tech-prep curriculum emphasizes competencies needed for an increasingly technological workplace in a sequenced program of studies in which students concentrate on a particular occupation. The curriculum is designed to help students gain academic knowledge and technical skills. Students often earn college credit for secondary coursework. Also, the curriculum provides a foundation for acquiring advanced occupational competencies at the postsecondary level, particularly in associate degree or certificate programs in a specific occupation. Roughly 47% of high schools in the United States offer tech-prep curriculum to students (U.S. Department of Education, 2006).

Tech-prep, according to the Georgia Department of Education (2006), provides high school students with career-related programs of study that are articulated between secondary and postsecondary education and employment. The mission of Georgia tech-prep programs is to provide high school students with an opportunity to participate in a seamless educational system that includes high-level academic and technical preparation for workforce readiness and lifelong learning.

In 1998, the federal Perkins legislation was reauthorized and included tech-prep as a separate title. In addition to adding prominence, there was an increased emphasis on accountability. Responsibility was placed on administrators at all levels to prove the effectiveness of tech-prep. Research must reflect that the investment of funds is making a difference. Since 2003, the Perkins legislation has been undergoing reauthorization. In July 2006, the newest Perkins legislation was signed into law. The new Perkins Act will provide around $1.3 billion in federal support for career and technical education programs. The new law will extend through 2012 (Reiter, 2006). Accountability measures of the new Perkins legislation make data collection and analysis of tech-prep a priority. Data is needed to show the effectiveness of tech-prep. However, to date, the collection and analysis of tech-prep data at the local, state, and federal levels has been minimal. Only a small percentage of tech-prep programs are implementing formal evaluations and most of these are in the preliminary stages (Ruland & Timms, 2001).

Tech-prep programs use time and resources designed to prepare students for postsecondary education, but approximately 41% of freshmen entering two-year postsecondary education enroll in remedial reading, writing, or mathematics courses (Perin, 2002). Tech-prep is also designed to prepare students for highly skilled technical occupations, but employers complain that employees lack basic skills such as reading, writing, and mathematics (Rosenbaum, 2001).

Hull (2004) proposes that career pathways are the next generation of tech-prep. Even though tech-prep has been regarded as a separate track in career and technical education, it has been the change agent underlying the conceptualization, design, development, and modeling of innovative improvements in education. *Career pathways* are "a coherent, articulated sequence of rigorous academic and career/technical courses, commencing in the ninth grade and leading to an associate degree, baccalaureate degree and beyond, an industry-recognized certificate, and/or licensure" (p. 6). Georgia is in the process of a tech-prep transformation that includes career pathways. Career pathways will be an umbrella initiative and their structure will evolve through time and align educational, economic, and social entities to help students obtain skills needed in the workforce. The career pathways system will adapt programs such as tech-prep and enable students to advance to higher levels of education and employment (Myers, 2007).

Fifteen years after the initial implementation of tech-prep—through funding provided by the Carl D. Perkins Vocational and Applied Technology Education Act of 1990—the demand for a workforce with academic and career and technical skills is still growing. Tech-prep has been widely effective in creating articulation agreements, developing advanced skills, improving academic achievement through contextual teaching, integrating academic and technical courses, and increasing graduation rates (Hull, 2004). It is still imperative to continuously collect and analyze data to hold tech-prep programs accountable at the local, state, and federal levels. With recent changes to redefine the Perkins legislation through the use of career pathways, tech-prep must demonstrate its contribution to student achievement, program completion, and placement in postsecondary education and the workforce (Hoachlander, 1999).

Past research on outcomes of tech-prep participants has focused primarily on student outcomes at the secondary level (e.g., Atkinson, 1996; Bragg, Layton, & Hammons, 1994; Fellers, 1994; Grubb, Badway, Bell, & Kraskouskas, 1996; Hershey, Silverberg, & Owen, 1995; Hershey, Silverberg, Owen, & Hulsey, 1998; Klimbal, 1996). Student outcomes are typically measured by high school drop-out rates, graduation test scores, grade point averages, attrition rates, Asset test scores, licensure passing rates, or intent to pursue postsecondary education. Much of the research is limited or inconclusive, however, due to poor identification of tech-prep participants.

Oswald (2002) provided evidence that tech-prep participants had higher levels of attendance and were more likely to gain credits toward graduation, but student identification and implementation was an issue. In addition, positive results for tech-prep programs were found in a study by Bragg, Loeb, Gong, Deng, Yoo, and Hill (2002) where tech-prep participants were much more likely to have a vocational concentration and enroll in postsecondary education, but again implementation of the tech-prep model was a factor in the results. Cellini (2005) reported that tech-prep students were more likely to complete high school and attend a two-year college. Most substantial changes in student outcomes have been reported at the secondary level and are less common at the postsecondary level (Grubb, 1995).

Few studies assess the influence of tech prep programs on student outcomes at the postsecondary level. Several studies that do assess postsecondary student outcomes show mixed results. For example, Krile and Parmer (2002) reported that tech-prep programs have a positive effect on student outcomes, while Graham (1996) found that students graduating from a college-prep track achieve at higher levels than students graduating with a tech-prep diploma. Parkhill's (1998) findings suggest that following a tech-prep track does not better prepare students for enrollment in postsecondary education. Bragg et al. (2002) found that a vast majority of postsecondary students, those from both non-tech prep and tech-prep secondary programs, required remedial courses. Also, they found students who had a tech-prep concentration in high school were more likely to enroll in that concentration, but did not enroll with sufficient hours to finish a certificate or degree. Student outcomes in these studies were measured using Asset test scores, grade point averages, and completion rates. Further research was recommended to examine student outcomes and tech-prep program effectiveness on postsecondary education level performance.

Purpose Statement

Major emphasis has been placed on tech-prep programs during the past decade. The most recent national evaluation of tech-prep programs, conducted in 2004, found data on tech-prep student outcomes to be positive. While students are better prepared for both college and the workplace, tech-prep has not been a widely effective strategy for improving student outcomes at the postsecondary level (U.S. Department of Education, 2006). If tech-prep programs are to maximize the preparation of students for both work and postsecondary education, it is imperative that postsecondary outcomes of high school students graduating from tech-prep programs be examined. Therefore, the purpose of this study was to examine the postsecondary outcomes of tech-prep graduates entering 2-year technical colleges directly from high school after two years of study at the technical college level. Specific measures of student outcomes included indicators of need for mathematics, reading, and writing remediation and successful completion rates from diploma, technical certificate, and Associate of Applied Science Programs.

Research Questions

1. What are the characteristics of tech-prep and non-tech prep students entering 2-year technical colleges directly from high school in relation to gender, minority status, and type of technical college program pursued?
2. Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school differ in the need for remediation (mathematics, reading, and writing) for the different technical college programs pursued (diploma, technical certificate, and Associate of Applied Science)?
3. Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school have different successful completion rates for each type of technical college program pursued (diploma, technical certificate, and Associate of Applied Science)?

Conceptual Framework

Tech-prep is a school reform movement aimed at strengthening the academic preparation of students who pursue secondary programs in career and technical education and postsecondary programs in a variety of specific occupational preparation areas which ultimately lead to employment (Cantor, 1999). The idea that students learn more quickly through the integration of academic and vocational skills has been around for centuries. Dewey (1916), in *Democracy in Education,* stressed that education through occupations is more conducive to learning, and, in fact, the integration of vocational and academic curriculum was a major policy objective throughout the twentieth century (Hoachlander, 1999). The concept of integration has been a key strategy for improving teaching and learning in schools (Stasz, Kaganoff, & Eden, 1995).

Education through occupations tries to eliminate the unproductive division between academic and vocational courses in school by teaching both theory and application of conventional subjects (Grubb, 1995).

The tech-prep program contains seven essential elements which provide a general template for tech-prep planning and implementation at state and local levels. By understanding the intent of each element, a conceptual schema is assumed where implementation and student outcomes can be assessed (Bragg et al., 2002). Ultimately, Perkins should be judged in terms of outcomes (Stecher, Hanser, Hallmark, Rahn, Levesque, Hoachlander, et al., 1994). The seven elements as defined by Perkins law include:

(1) articulation agreements between secondary and postsecondary consortium participants,

(2) 2+2, 3+2, or a 4+2 design with a common core of proficiency in math, science, communication, and technology,

(3) specifically developed tech-prep curriculum,

(4) joint in-service training of secondary and postsecondary teachers to implement the tech-prep curriculum correctly,

(5) training of counselors to recruit students and to ensure program completion and appropriate employment,

(6) equal access of special populations to the full range of tech-prep programs,

(7) and preparatory services such as recruitment, career and personal counseling, and occupational assessment (U.S. Department of Education, 2006).

Perkins legislation outlines the expected student outcomes of tech-prep which include:

(1) associate degree or a 2-year certificate,

(2) technical preparation in at least one field of engineering, technology, applied science, mechanical, industrial, or practical art or trade, or agriculture, health or business,

(3) competence in math, science, and communication,

(4) and employment (U.S. Department of Education, 2006).

By using the tech-prep program outline as a conceptual framework, it was possible to link tech-prep standards or elements and expected student outcomes. The implementation of Perkins performance measures and standards were judged in terms of student outcomes (Stecher et al., 1994). The tech prep program at the high school level was the foundation for students to reach a student outcome at the post-secondary level. With proper implementation of the tech-prep program, students should have been able to reach outcomes as outlined by Perkins legislation.

Significance of Study

Nearly 85 years ago the U.S. government committed to technical education as a national priority. Since then career and technical education has grown to encompass programs such as tech-prep. Nearly half of all high school students are involved in career and technical education as a part of their high school studies (Silverberg, Warner, Fong, & Goodwin, 2004). It is estimated that as many as 40 million adults engage in short-term postsecondary occupational training (Darkenwald & Kim, 1998). Considering the federal commitment to tech-prep and the growing number of participants, this study contributes to our understanding of the impact of tech-prep programs on student outcomes at the technical college level.

With the increased emphasis placed on accountability, it was important to examine tech-prep and measure tech-prep student outcomes. Exploring the postsecondary outcomes of students who completed tech-prep programs in high school provided important information for students, counselors, teachers, and educational administrators at the secondary and postsecondary level.

Students can make informed decisions about diploma track, articulation, and career choices. Counselors can better advise students about career and program offerings. Teachers can better understand the level of effectiveness of educational programs, possess knowledge about the academic skills and abilities of students, and modify and enrich the academic base of programs. Administrators are informed on how to make decisions concerning allocation of resources regarding career and technical education. By assessing the student outcomes, it was possible to make improvements in tech-prep and the implementation of tech-prep.

Every worker in the U. S. must develop academic and technical skills to become productive in the labor market. With the growing complex and high tech workplace, it is imperative that students get the skills they need to compete in the economy. As tech prep becomes more widely accepted by educators and the business community, it was important to examine the extent to which tech prep was succeeding at preparing a labor force (Brown, 1998a). This study assessed tech prep and its impact on student outcomes as they prepare for entry into the labor market.

CHAPTER 2

REVIEW OF LITERATURE

Tech-Prep Education

Tech-prep is a high school reform movement aimed at strengthening the academic preparation of students who pursue secondary programs in career and technical education and postsecondary programs in a variety of specific occupational preparation areas that lead to employment (Cantor, 1999). Tech-prep was given major emphasis in the Carl D. Perkins Vocational and Applied Technology Education Act of 1990 and was amended in the School-to-Work Opportunities Act of 1994. Tech-prep involves partnerships between schools, employers, families and community leaders. Also, tech-prep is a process of teaching and learning that expects the same level of high achievement from all students, recognizes and addresses a variety of learning styles, and integrates practical application into academics. Tech-prep is a curriculum structure that is central, but not limited to, grades 9-12 at the secondary level and continues to the post-secondary level, keeps student choices and career and educational options open, and prepares students for critical thinking and lifelong learning. The purpose of tech-prep is to prepare any student to enter and succeed in a postsecondary institution or career (ABC's of Tech-prep, 1999).

Federal Definition of Tech-Prep

Tech-prep, as defined by the Carl D. Perkins Vocational and Applied Technology Education Act of 1990, focuses on preparing young people to transition directly into the workplace or into higher education upon graduation from high school. The tech-prep curriculum emphasizes competencies needed for an increasingly technological workplace in a sequenced program of studies in which students concentrate on a particular occupation. The curriculum is designed to help students gain academic knowledge and technical skills. Students often earn college credit for secondary coursework. Also, the curriculum provides a foundation for acquiring advanced occupational competencies at the postsecondary level, particularly in associate degree or certificate programs in a specific occupation. Tech-prep is an important school-to-work transition strategy, helping the middle population of students make the connection between school and employment (U.S. Department of Education, 2006).

Tech-prep education is a 2+2, 3+2, or 4+2 planned sequence of study in a technical field beginning as early as the ninth year of school. The sequence extends through two years of postsecondary occupational education or an apprenticeship program of at least two years following secondary instruction and culminates in an associate degree or certificate. The Perkins law requires that tech-prep programs have seven elements:

1. an articulation agreement between secondary and postsecondary consortium participants;
2. a 2+2, 3+2 or 4+2 design with a common core of proficiency in math, science, communication, and technology;
3. a specifically developed tech-prep curriculum;
4. joint in-service training of secondary and postsecondary teachers to implement the tech-prep curriculum effectively;
5. training of counselors to recruit students and to ensure program completion and appropriate employment;
6. equal access of special populations to the full range of tech-prep programs; and,

7. preparatory services such as recruitment, career and personal counseling, and occupational assessment (U.S. Department of Education, 2006).

States are required to give priority consideration to tech-prep programs that offer effective employment placement, that transfer to four-year baccalaureate programs, that are developed in consultation with business, industry, labor unions, and institutions of higher education that award baccalaureate degrees, and that address dropout prevention as well as re-entry and the needs of special populations. Specific outcomes for students in tech-prep programs include:

1. an Associate degree or a two-year certificate;
2. technical preparation in at least one field of engineering technology, applied science, mechanical, industrial, or practical art or trade, or agriculture, health, or business;
3. competence in math, science, and communication; and,
4. employment (U.S. Department of Education, 2006).

Section 202(a)(3) of Perkins III defines *tech-prep program*

> as a program of study that: combines at a minimum two years of secondary education (as determined under state law) with a minimum of two years of postsecondary education in a nonduplicative, sequential course of study; integrates academic and career and technical instruction, and utilizes work-based and worksite learning where appropriate and available; provides technical preparation in a career field such as engineering technology, applied science, a mechanical, industrial, or practical art or trade, agriculture, health occupations, business, or applied economics; builds student competence in mathematics, science, reading,

> writing, communications, economics, and workplace skills through applied, contextual academics and integrated instruction in a coherent sequence of courses; leads to an associate or a baccalaureate degree or a postsecondary certificate in a specific career field; and leads to placement in appropriate employment or to further education.

An allowable tech prep program must meet the terms of this definition (D'Amico, 2003).

Section 204(c) of Perkins III states that a tech-prep program shall be carried out under an articulation agreement between participants in a consortium. Also, a program should consist of at least two years of secondary school preceding graduation and two years or more of higher education, or an apprenticeship program of at least two years following secondary instruction. A common core of required courses should be followed with a proficiency in mathematics, science, reading, writing, communications, and technologies designed to lead to an Associates degree or a postsecondary certificate in a specific career field (D'Amico, 2003).

Tech-prep consortiums should meet academic standards developed by the state. Also, they should link secondary schools and two-year postsecondary institutions, and, if possible and practical, four-year institutions of higher education through nonduplicative sequences of courses in career fields, including the investigation of opportunities for tech-prep secondary students to enroll concurrently in secondary and postsecondary coursework. Programs should use, if appropriate and available, work-based or worksite learning in conjunction with business and all aspects of an industry. In addition, programs should use educational technology and distance learning, as appropriate, to involve all consortium partners more fully in the development and operation of programs (D'Amico, 2003).

Tech-prep programs should include in-service training for teachers that is designed to train vocational and technical teachers and effectively implement tech-prep programs. Programs should provide for joint training of teachers in the tech-prep consortium. Also, they should be designed to ensure that teachers and administrators stay current with the needs, expectations, and methods of business and all aspects of industry. Programs should focus on training postsecondary education faculty in the use of contextual and applied curricula and instruction and provide training in the use and application of technology (D'Amico, 2003).

Tech-prep programs should include training programs designed to enable counselors to more effectively provide information to students regarding tech-prep education programs. Programs should support student progress in completing tech-prep programs and provide information on related employment opportunities while ensuring that such students are placed in appropriate employment. Programs should stay current with the needs, expectations, and methods of business and all aspects of an industry and provide equal access to individuals who are members of special populations, including the development of tech-prep program services appropriate to the needs of special populations (D'Amico, 2003).

Georgia Definition of Tech-Prep

Tech-prep, according to the Georgia Department of Education (2006), provides high school students with career-related programs of study that are articulated between secondary and postsecondary education and employment. The mission of Georgia tech-prep programs is to provide high school students with an opportunity to participate in a seamless educational system that includes high-level academic and technical preparation for workforce readiness and lifelong learning. Tech-prep culminates in a postsecondary diploma, Associate degree, or baccalaureate degree and employment in a technical, supervisory, or management position. Tech-prep aligns two to four years of high school instruction with two to four years of postsecondary instruction in programs of study that lead to advanced levels of employment in high-demand career fields. To facilitate the tech-prep advantage, 37 local consortia have been developed throughout the state in conjunction with technical programs available for students in the surrounding areas (Georgia Department of Education, 2006).

Tech-prep provides a student with an individual career plan that focuses on a tech-prep career major, incorporates academic and career-related courses aligned (articulated) between secondary and postsecondary levels, and leads to a certificate, diploma, degree, or apprenticeship. Tech-prep encourages students while they are in high school to examine careers, select a career major, and enter a plan of study (individual career plan) that will lead to that career. All students should explore career possibilities and participate in an individual career plan. A career plan helps students discover their interests and abilities and gives them focus in their educational pursuits. The plan guides them in what they must do and why, but it also helps them design and build portfolios to document their accomplishments (Georgia Department of Education, 2006).

A secondary tech-prep student is a high school junior or senior who has completed two or more technology/career courses from a tech-prep career major or path that have been identified in the state database as aligning with a postsecondary program leading to a postsecondary credential. A secondary completer will be identified by the state according to this definition as well as a student graduating with a diploma. A postsecondary tech-prep student is a student who has transitioned from a secondary school to postsecondary education having completed secondary courses from a tech-prep career major or path that has been identified in the state database (dual enrollment matrix or articulated course listing) as aligning with a postsecondary program leading to a postsecondary credential. A tech-prep completer is a student who has successfully completed the secondary and postsecondary requirements of an aligned or articulated tech prep career major (program of study), resulting in a postsecondary Associates degree, diploma, or certificate (Georgia Department of Education, 2006).

Secondary school responsibilities in tech prep programs are to support the use of individual career plans for all students and support seamless alignment (articulation) agreements through instructor participation in local alignment meetings. Local agreements should be developed and reviewed annually to maintain standards. Tech-prep career majors (or career programs of study) will be developed locally by showing the alignment of courses and how they fit into a career major that leads to a high-demand occupation requiring a postsecondary credential. This will help students, parents, and educators see the connection between secondary and postsecondary education, the opportunities available, and the path needed to reach a career destination. Academic and career technical courses should be integrated to emphasize building student competence in mathematics, science, reading, writing, communications, economics, and workplace skills through contextual academics and integrated instruction in a coherent sequence of courses. This type of academic core gives students the ability to learn more academics and to learn new and different technical skills that build on the academics (Georgia Department of Education, 2006).

Four career-specific courses are recommended, but only two in a career area are required. Tech-prep students are prepared for high skill technical careers that require postsecondary education. Students may also be earning postsecondary credit while in high school through dual or joint enrollment. In order to facilitate students' transition from secondary to postsecondary education, secondary schools should complete the documentation of articulated credit (or other forms as required by the postsecondary institution) to determine if the student has met the criteria to receive advanced or articulated credit. Also, they should provide the student with information about admissions requirements and how validation of credit is completed (varies at different technical colleges) at the technical college (or other college) of choice. In addition, they should provide a transcript indicating the aligned (articulated) courses. If possible, tech prep should be indicated on the transcript to help the college registrar (Georgia Department of Education, 2006).

Coosa Valley Tech Prep Consortium Definition of Tech-Prep

The mission of Coosa Valley Area Tech-Prep Consortium is to provide expanded opportunities for students in traditional college prep and/or technical career prep programs. The consortium recognizes the need to produce a highly educated and qualified workforce that is responsive to the needs of business and industry. Through this community partnership, students are provided a seamless transition from high school to postsecondary education and to the workforce through rigorous academic and technical preparation. The mission of the consortium also acknowledges and accepts the concepts and guidelines recommended by the Georgia Department of Education and the Georgia Department of Technical and Adult Education (Coosa Valley Area Tech Prep, 2006).

Tech-prep, as defined by Coosa Valley Area Tech-Prep Consortium, is a nationwide career development system that provides students with a planned program of study that incorporates academic and career-related courses articulated between the secondary and postsecondary levels leading to a diploma, degree, or two-year apprenticeship certificate. A secondary tech-prep student is a high school junior or senior that has completed two or more technology or career courses that have been identified in the state database as aligning with a postsecondary program leading to a postsecondary credential. A postsecondary tech-prep student is a student who has transitioned from a secondary school to postsecondary education with a tech-prep program of study instructional plan derived from a signed tech-prep articulation agreement between the secondary school system and the postsecondary institution. A tech-prep completer is a student who has successfully completed the secondary and postsecondary requirements of an articulated tech-prep program of study, resulting in a postsecondary Associate degree, diploma, or a certificate (Coosa Valley Area Tech Prep, 2006).

Tech-prep students may be eligible to receive advanced placement credit at any technical college in Georgia. This advanced placement credit is based on the articulation agreement developed between the Georgia Department of Education and the Georgia Department of Technical and Adult Education. The agreement is designed to aid in a seamless transition from high school to postsecondary education without repetition of coursework already mastered in high school. Certain courses have been identified and evaluated through a formal process to insure that the same competencies are included in both the high school curriculum and the technical college curriculum. The following criteria must be met in order to receive technical advanced credit: a) students must receive a grade of 85 or higher on the final transcript to qualify for technical advanced placement credit; b) students must claim technical advanced credit by enrolling in a technical college within 18 months after graduation; and c) the number of advanced placement credits available will vary according to the program of study the student is pursuing at the postsecondary level (Coosa Valley Area Tech Prep, 2006).

For the purpose of this study, tech-prep was defined using the Coosa Valley Tech Prep Consortium definition. This definition fits the criteria for the state and federal requirements of tech-prep. In addition, the Coosa Valley Tech Prep definition was used by the sample and population of the study. By using this definition, results from the study can be best interpreted.

Articulation and Dual Enrollment

Articulation is a component of tech-prep. The term *articulation agreement* means “a written commitment to a program designed to provide students with a nonduplicative sequence of progressive achievement leading to degrees or certificates in a tech-prep education program” (ABC’s of Tech-prep, 1999). True articulation involves bringing together faculty members, business and industry representatives, and others to discuss curriculum at the secondary and postsecondary level. The examination of curriculum assesses how content matches up and whether adjustments are needed in order to eliminate duplication. Articulation is the sharing of resources and redesigning of courses (Kerr, 2001). In order to ensure the elimination of repetitive coursework, students and parents must understand that the selected career paths are well planned, continue beyond the 12th grade, and provide a smooth transition to a postsecondary school (Black, 1995).

Articulation agreements between secondary and postsecondary schools may be produced in a variety of ways. General agreements are only the beginning of articulation; articulation involves cooperation and collaboration. Georgia’s statewide tech-prep articulation agreement coordinates instruction, student services, and administrative personnel of the public school systems, the Department of Technical and Adult Education postsecondary schools, and three Board of Regents universities with technical divisions that offer Bachelor of Applied Science (BAS) cooperative degree programs (Breeden, 1999). The BAS program articulates with the state’s 32 technical colleges and the 3 colleges that offer BAS programs (Murdock, 1999).

Students and schools benefit from articulation agreements. Articulation promotes entry into postsecondary programs by encouraging students to earn transferable credit while in high school. Postsecondary programs can be completed in less time by eliminating duplicated course content. Postsecondary tuition and credit validation fees are waived for articulated courses in Georgia. Easy movement among high schools, technical colleges, colleges, and universities allow students to pursue a multifaceted education. Tech-prep and articulation can help to achieve the skills for a new workforce (Proctor & McElvey, 2001).

Dual credit is also a component of tech-prep. Dual credit or enrollment amplifies the usefulness and applicability of the 11th and 12th grades, maximizes state and local educational resources, and provides a platform that fosters collaboration and interdependence between secondary and postsecondary institutions. By aligning program content and reducing curricular duplication, dual credit impacts educators, students, and institutions. Secondary to postsecondary linkages are strengthened to the point that students are enrolled in college before graduating from secondary school (Kerr, 2001). Students, parents, and educational institutions can experience benefits from dual enrollment, because it provides a head start on postsecondary core requirements. Also, it lowers the cost of college credits and extends the variety of classes available. In addition, it allows for shared resources and provides a coordinated, seamless education. Also, it reduces the need for remediation upon full-time college enrollment. Last, it gives students a controlled introduction to college life (Bond, 2001).

History and Development of Tech-Prep Education

The first federal legislation for career and technical education was the Smith-Hughes Act of 1917. This legislation established the pattern of federal/state/local collaboration in initiating and implementing public career and technical education programs for students pursuing less than a baccalaureate degree. The Smith-Hughes Act was a national endorsement in an attempt to cope with problems of industrialization, automation, urbanization, and the need for skilled labor (Sarkees-Wircenski & Wircenski, 1999). The Smith-Hughes Act emphasized job specific skills to the exclusion of the traditional academic curriculum. Snedden and Prosser's views were apparent in the Smith-Hughes Act, where the purpose of education was to meet the needs of business and industry (Rojewski, 2002). The Vocational Education Act of 1963, with amendments in 1968, 1972, and 1976, incorporated the permanent authority of the Smith-Hughes Act by preparing students for the workforce through job specific skills (Hogg, 1999).

Recent changes in career and technical education policy and practice can be traced back to the early 1980s with the *back-to-basics* movement. The landmark 1983 Carnegie report, *A Nation at Risk,* asserted that all graduating high school students must possess a certain level of basic academic skills in order to be successful. In response, curriculum reform began to emphasize academic education. The resulting focus on academic education resulted in career and technical education programs being devalued, de-emphasized, or even downsized in many schools. However, a highly academic, i.e., college-prep, curriculum is often highly abstract in nature and does not meet the needs of a majority of students. In fact, 3 out of 4 students in the U.S. public education system are unlikely to ever earn a four-year baccalaureate degree, but most schools and colleges operate under the assumption that they will (Parnell, 1994). Even so, there was a widespread belief that a four-year college degree was necessary to ensure economic success (Gray, 2002). The Carl D. Perkins Vocational Education Act of 1984 sought only to assist states to expand, improve, modernize, and develop quality vocational-educational programs to meet the needs of the nation's future workforce by improving productivity and promoting economic growth, but the act did not address the lack of basic academic skills in the majority of students (Hogg, 1999).

Parnell (1985), in his book *The Neglected Majority*, addressed the problem he saw with non-college bound students being neglected by public education reform. He described students being forced into a rigorous high school curriculum where they did not develop critical thinking skills, had no exposure to the labor force, and did not receive career or guidance counseling. Parnell proposed a *tech-prep* curriculum to provide the neglected majority (i.e., the middle 50% of students) a bridge between high school academic skills and technical skills for employment.

The purpose of tech-prep was to combine high academic standards and technical training, ensure program articulation into higher education, and prepare students for high skilled technical occupations. In 1988, *The Forgotten Half* (William T. Grant Foundation) revealed that a majority of high school students lacked basic academic skills, as well as skills for life and work. This report acknowledged that not all students would go to college, and the challenge was to prepare all students for work and adult life. No consideration was given to enhancing the school-to-work transition of noncollege-bound students.

In 1990, Congress amended the Carl. D. Perkins Vocational Education Act of 1984 to allocate funding for tech-prep program development. Tech-prep was given major emphasis in the Carl D. Perkins Vocational and Applied Technology Education Act of 1990 and was amended in the School-to-Work Opportunities Act of 1994. In 1998, the federal Perkins legislation was reauthorized and included tech-prep as a separate title. Since 2003, the Perkins legislation has been under reauthorization (National Tech Prep Network, 2006).

Tech-prep is a career and technical education reform movement to prepare students for postsecondary education and the workforce through the use of partnerships, the process of teaching and learning, and an integrated, structured curriculum. The tech-prep program offers flexibility, which makes program development adaptable to local needs, but makes identifying tech-prep participants and completers and program concepts difficult. Some argue that tech-prep only tracks students in career and technical coursework, but others see tech-prep as a legitimate program with students who enroll and complete a sequenced program of studies (Craig, 1999).

The emergence of tech-prep resulted from the convergence of two critical elements in American society: the shift from an industrial to a technology-driven economy with a growing demand for high-skilled workers and the state of American high schools, which critics claimed were preparing only the top 25% of students. Most U.S. students were graduating from high school with low academic achievement, and career and technical education in high schools and colleges had become a dumping ground for problem students and low achievers. The general track in U.S. schools was being used for social promotion of students. To remain competitive in the new global economy, business and industry had to replace low-skill, high-wage workers with a high-skilled technological workforce (ABC's of Tech-prep, 1999). In 1990, this reality was documented through a publication key by the National Center on Education and the Economy's Commission on the Skills of the American Workforce titled *America's Choice: High Skills or Low Wages* (Hogg, 1999).

Employers and educators began working together to solve this concern by eliminating the general track diploma, replacing dead-end career and technical courses, and setting higher academic goals for all students.The *Neglected Majority* by Dale Parnell (1985) expressed the need for career and technical education programs to better serve the middle quartiles of high school students in completing associate degrees. Parnell stressed the importance of a solid foundation in academics in order for high school graduates to succeed beyond secondary school. Without this academic foundation, it was increasingly difficult for students to complete a college degree or enter into the workforce. Thus, the concept of the Tech-prep Associate Degree (TPAD) program was established (Craig, 1999).

Career and technical education throughout the beginning and middle decades of the twentieth century emphasized acquiring occupational skills to master jobs in the workplace. Little emphasis was placed on learning the academic disciplines. It is correct to describe early career and technical education as learning the *how* (hand skills). Learning the *why* (head skills) was not emphasized (Hull & Parnell, 1991). Parnell encouraged the government to fund technical education programs that emphasized academic skills. Hull and Parnell strongly urged the use of applied academics, a balance of head skill and hand skill, to contextualize learning. Parnell, along with federal legislators, lobbied for the creation of a 2 + 2 program for technical education that would lead to completion of an associate degree through the tech-prep model (Craig, 1999).

In 1990, Congress amended the Carl. D. Perkins Vocational Education Act of 1984 to allocate funding for tech-prep program development. Legislation required that funded programs include the following seven elements: (a) articulation agreements-the effective link between 2-year secondary schools and postsecondary schools; (b) a 2 + 2 design-with a common core of math, science, communication, and technology; (c) a tech-prep curriculum-enriched applied instruction; (d) joint staff development for secondary and postsecondary faculty; (e) training to promote effective student recruitment, retention, and post-program placement; (f) measures to ensure access for special populations; and (g) preparatory services to include counseling and assessment. In Section 343.(3) the law states:

> The term *tech-prep education program* means “a combined secondary and postsecondary program that A) leads to an associate degree or two-year certificate; B) provides technical preparation in at least one field of engineering technology, applied science, mechanical, industrial or practical art or trade, or

agriculture, health or business; C) builds student competence in mathematics, science, and communications (including through applied academics) through a sequential course of study; and D) leads to placement in employment." (Hull & Parnell, 1991, p. 71)

At this time when the need for improved academic and technical coursework was recognized, employers were calling for improved "employability skills." Schools and employers needed to work together to close the skills gap. Without the alignment of school and employers, many young people would leave school without the knowledge, skills, or foundation to find a good job (Hogg, 1999). In 1990, the Secretary's Commission on Achieving Necessary Skills (SCANS, 1991) was established to examine workforce demands. The report titled *What Work Requires of Schools: A SCANS Report for America 2000* called for a third set of standards. In addition to academic and technical skills, employers needed workers who could think critically, use information and technology, work in teams, and solve problems (National Tech Prep Network, 2006).

In 1994 the Goals 2000: Educate America Act, which promoted improved academic achievement among students, was signed into law. Goals 2000 consisted of five key elements including a) a challenge to the nation based on eight specific, measurable education goals, b) incentive funding to encourage comprehensive state and local planning, c) accountability to measure progress and achievement, d) target all children, and e) emphasis on system wide reform. A major objective of Goals 2000 focused on the relationship between academic skills and productive employment, preparing all youth to pursue postsecondary education (Orr, 1998). Also in 1994, the School-to-Work Opportunities Act was signed into law, which states that business, community agencies, and schools need to develop partnerships to better prepare students for the changing nature of work and employability. The School-to-Work (STW) legislation emphasized three foundations of development: 1) school-based activities; 2) work-based activities; and 3) connecting activities. Just as STW was an umbrella for initiatives such as tech-prep, Goals 2000 was an even larger umbrella that encompassed many school reform efforts (Paris, 1994). In 1999, Congress refused to reauthorize Goals 2000 (Superfine, 2005).

In 1998, the federal Perkins legislation was reauthorized and included tech-prep as a separate title. In addition to adding prominence, there was an increased emphasis on accountability. Responsibility was placed on administrators at all levels to prove the effectiveness of tech-prep. Research must reflect that the investment of funds is making a difference. Since 2003, the Perkins legislation has been going through another reauthorization (National Tech Prep Network, 2006). Career and technical education stands to lose $1.3 billion in federal funding if the Carl D. Perkins Vocational and Technical Education Act is eliminated. In addition, the Perkins Act contains two provisions that impact the appropriation of local funds: a *maintenance of effort* provision where states must continue to invest as many resources as they have in the past in order for federal appropriations to stay level or increase and a *matching* provision that requires states to match dollar-for-dollar federal funding available for administrative expenses. During a time of increasing budget pressure and cuts across programs, Georgia could stand to lose $38,897,797 in funding for career and technical education if reauthorization for the Perkins legislation does not occur (Hyslop, 2006). Since 2003, the Perkins legislation has been undergoing reauthorization. In July 2006, the new Perkins legislation was signed into law. The new Perkins Act will provide around $1.3 billion in federal support for career and technical education programs. The new law will extend through 2012 (Reiter, 2006).

Georgia is in the process of a tech-prep transformation that includes career pathways. Career pathways will be an umbrella initiative and their structure will evolve through time and align educational, economic, and social entities to help students obtain skills needed in the workforce. The career pathways system will adapt programs such as tech-prep and enable students to advance to higher levels of education and employment (Myers, 2007). Hull (2004) proposes that career pathways are the next generation of tech-prep. Even though tech-prep has been regarded as a separate track in career and technical education, it has been the change agent underlying the conceptualization, design, development, and modeling of innovative improvements in education. *Career pathways* are "a coherent, articulated sequence of rigorous academic and career/technical courses, commencing in the ninth grade and leading to an associate degree, baccalaureate degree and beyond, an industry-recognized certificate, and/or licensure" (p. 6).

Framework for Tech-Prep Education

Career and technical education in the early twentieth century followed the theories of Snedden and Prosser, who suggested that the mission of public schools was to further the good of society by contributing to its social efficiency; therefore, the purpose of career and technical education was to prepare well-trained compliant workers for the efficient society (Simon, Dippo, & Schenke, 1991). At the same time an emerging teaching and learning theory, *behaviorism*, was proposed that suggested learning resulted from links formed between stimuli and responses. Concurrently, another theory was developed, *constructivism*, which argued students construct their own knowledge by testing ideas based on prior knowledge and experience (Berns & Erickson, 2001). Constructivism, rooted in the theories of John Dewey, calls for active participation in problem solving and critical thinking, involving authentic learning that students find relevant and engaging (Briner, 1999). Dewey's work is viewed as a significant part of the foundation of *pragmatism* (Miller & Gregson, 1999). A number of current educational reform efforts such as applied academics, contextualized teaching and learning, integrated curriculum, and authentic assessment reflect Dewey's notion of pragmatism (Rojewski, 2002).

Behaviorism is the study of behavior and its causes (Thorkildsen, 2005). Behaviorism has served as the basic teaching and learning model for career and technical education, as with most education (Berns & Erickson, 2001). Instructional goals are couched in the language of behavioral objectives. Instruction consists of specific activities that learners experience. All activities are governed by behaviorist theory, which suggests that all important learning outcomes can be achieved with the right mix of stimulus environments. Teachers are seen as deliverers of engineered instruction. Learners are passive recipients of the events they experience (Royer, 2005).

Behaviorism is a psychological approach that concentrates on observable behavior rather than the conscious working mind. Behaviorists assert that what goes on inside the mind is not externally observable; therefore, it is not an appropriate object of study, but behavior can be observed and quantified (Parnell, 1985). Behaviorism has served as the basic teaching and learning model for career and technical education. Although both behaviorism and constructivism involve student participation, career and technical education has not included constructivist approaches to the extent it has embraced behaviorism (Berns & Erickson, 2001). Most instruction is based on the behaviorist assumption that knowledge can be taught independent of context, and such learning can be evaluated with non-authentic/non-performance methods (Berrymen, 1991). Current research in teaching and learning support the constructivist perspective which reflects a paradigm shift from teacher-centered pedagogy based on behaviorism to a learner-centered educational approach based on cognitive theory (Gagon & Collay, 1997).

Constructivism is an especially appealing learning theory for teachers who are trying to prepare students with skills that will enable them to succeed in a workplace. It supports the value of collaboration, personal autonomy, reflection, active engagement, and individual determination of relevance (Savery & Duffy, 1995). According to the constructivist viewpoint, the essential role of career and technical education is to facilitate construction of knowledge through experiential, contextual, and social methods in real world environments (Lynch, 1997). In career and technical education, constructivist learning environments should incorporate learner-centered teaching practices, problem-based learning, contextual teaching and learning experiences, integrated academic and career technical curriculum, and authentic assessments. The constructivist perspective transforms career and technical education from preparing students to be able to perform to preparing students to know what circumstances and in what way knowledge should be performed and applied. Most applications of constructivism in academic and career and technical education focus on ways to help learners construct knowledge that is meaningful to them and that reflects social representation, experiences, contexts, and authentic tasks (Brown, 1998b).

During the 1950s and 1960s, the cognitive revolution sparked by individuals, such as Edward Tolman, James Gibson, Noam Chomsky, and Jerome Burner (Parnell, 1985), presented learner centered views of educational theory. The cognitive theory focuses solely on the learner who is viewed as an active change agent that alters the nature of what is acquired from experience. Individual learners change the nature of what they experience to produce positive learning outcomes (Royer, 2005). Cognitive theorists stress the role of thinking in the learning process or the importance of knowing *why* (Brown, 1998b).

Cognition is the overall functioning of all mental abilities, such as perceiving, remembering, reasoning, and problem solving. Cognitive psychology is the study of knowledge and how people use it. Cognitive science is a field of scientific inquiry about knowing and thinking that draws knowledge from many specific disciplines and continues to develop and evolve (Parnell, 1985). The current view regarding cognitive theory is that learning can no longer be understood by focusing on individual experience, but the frame of analysis should broaden to include the social-culture the learner comes from (Royer, 2005). Cognitive science has shaped contextual learning by focusing on the learner and his or her experience (Parnell).

Contextual learning has roots in early educational psychology and philosophy. Wilhelm Wundt, a founder of modern psychology, advocated an integration of knowledge with experience and cognition as an activity, although William James, the father of contextual learning, gave contextual learning its most fertile resources for growth. James was a proponent of functional psychology; he contended that the mind operates in an active, purposeful way to organize thought and to process experience. Dewey, a pragmatist, said that James influenced his thinking. James was also a pragmatist; he was a leader in the pragmatist movement of philosophy, which believed that truth emerges from human experience rather than existing independent of experience and that beliefs and knowledge cannot be separated from action and experience. The cognitive process of connecting knowing and doing was central to James' contextual theory of learning (Parnell, 1985).

Contextualism is knowledge considered relative to the historical and cultural contexts in which it is generated (Thorkildsen, 2005). Pepper (1942) first identified contextualism as another word for pragmatism, as found in the work of Charles S. Peirce, William James, Henri Bergson, John Dewey, and George Herbert Mead. Pepper first used the term contextualism in a 1932 reference to John Dewey's pragmatism. Contextualism addresses the unique historical context of events and how these influence human development.

Contextual learning is rooted in a constructivist approach to teaching and learning (Brown, 1998b; Dirkx, Amey, & Haston, 1999). According to constructivist learning theory, Individuals learn by constructing meaning through interacting with and interpreting their environments (Brown, 1998b). Constructivism challenges the traditional approach to education by redefining the relationship between the learner and what is known. Contextual learning incorporates research in cognitive science and recognizes that learning is a complex process that involves much more than behaviorist approaches emphasizing drill and practice (Center for Occupational Research and Development, 2000). Drawing on its roots in constructivist learning theory as well as theories of cognition and learning, contextual learning has the following characteristics: (a) emphasizes problem solving, (b) recognizes that teaching and learning need to occur in multiple contexts, (c) assists students in learning how to monitor their learning so that they can become self-regulated learners, (d) anchors teaching in the diverse life contexts of students, (e) encourages students to learn from each other, and (f) employs authentic assessment (Clifford & Wilson, 2000).

Recent reform efforts in career and technical education draw heavily from Deweyan pragmatism. Such reform efforts include applied academics, experimental and/or contextualized learning, authentic assessment, project-based instruction, problem-based instruction, integrated curriculum, and service-learning. Tech-prep programs have been conceptualized and operationalized to reflect pragmatism, which has a constructivist model (Miller & Gregson, 1999). Tech-prep follows a cognitive model of teaching and learning that expects the same level of high achievement from all students, recognizes and addresses a variety of learning styles, and integrates practical applications into academics. In addition, tech-prep is a curriculum structure that is central, but not limited to, grades 9-14, keeps student choices and career and educational options open, and prepares students for critical thinking and lifelong learning. The purpose of tech-prep is to prepare any student to enter and succeed in a postsecondary institution or career (ABC's of Tech-prep, 1999).

Morris, Bransford, and Franks (1979) argue that knowledge learned but not explicitly related to relevant problem solving situations remains mostly inert, meaning the learner is unable to use it for anything practical when the opportunity arises, and thus such knowledge quickly disappears. For most students, skills and knowledge are best learned within the realistic context where students have the opportunity to practice and master outcomes, but in U. S. schools classes are taught in the non-contextual abstract that are only effective for a relatively small number of intellectual students. The disconnection of learning from the context of use is a problem of traditional schooling. The key for students is to provide contexts that facilitate the acquisition of expertise (Collins, Brown, & Newman, 1989).

Tech-prep programs contextualize learning by integrating academic and vocational curriculum. The idea that students learn more quickly through the integration of academic and vocational skills has been around for centuries. Dewey (1916), in *Democracy in Education,* stressed that education through occupations is more conducive to learning. In fact, the integration of vocational and academic curriculum has been a major policy objective throughout the twentieth century (Hoachlander, 1999). The concept of integration has been a key strategy for improving teaching and learning in schools (Stasz, Kaganoff, & Eden, 1995). Education through occupations tries to eliminate the unproductive division between academic and career and technical courses by teaching both theory and application of conventional subjects (Grubb, 1999). For most students, skills and knowledge are best learned in realistic contexts where students have the opportunity to practice and master outcomes that are expected of them (Morris, Bransford, & Franks, 1979).

The contextual learning theory states that learning occurs only when students process new information or knowledge in such a way that it makes sense to them in their own frames of reference, just as pragmatism where students find learning relevant and engaging. The contextual learning theory assumes that the mind naturally seeks meaning in context or in relation to the person’s current environment, and it does this by searching for relationships that make sense and appear useful. Students discover meaningful relationships between abstract ideas and practical applications in the context of the real world. Concepts are internalized through the process of discovering, reinforcing, and relating. Curricula and instruction based on this strategy are structured around five essential forms of learning: relating, experiencing, applying, cooperating, and transferring (National Tech Prep Network, 2006). Contextual teaching and learning is a concept that helps teachers relate subject matter content to real world situations and motivates students to make connections between knowledge and its applications. In addition, students make connections to their lives as family members, citizens, and workers (Berns & Erickson, 2001).

According to Hull (1993), contextual learning occurs only when students process new information or knowledge in a way that makes sense to them in their frame of reference. Tech-prep uses the applied academics approach to learning, which involves the teaching of academic content through the use of vocational applications. This follows the contextual learning concept in that it provides for learning in the context of life experiences, builds on what students already know, and applies learning in the context of how the knowledge can be used in the context of exploration, discovery, and invention (Lankard, 1995).

Tech-prep models emphasize context-based teaching, referred by Hull and Parnell (1991) as applied academics, a balance of head skill and hand skill and allows for cognitive apprenticeship experiences for students. Dare (2000) reported that applied academics are a means of promoting rigor, serve as a basis for contextual teaching and learning, and promote a connection between the classroom and the world of work. Applied academics instruction is characterized by group projects and discussions, requiring active participation of learners through teamwork and collaboration.

Thinkers and innovators such as Alfred North Whitehead, Maria Montessori, Howard Gardner, William James, and Jean Piaget believed that people learn best from experience. The contextual learning approach gives students a touchstone of reality upon which to build solid, meaningful learning. In the past few decades, brain research has shown the need for such connections is rooted in the basic function of the brain itself; teaching for connectedness is teaching in accordance with the way the human brain operates. The brain tends to discard information for which it finds no connection or meaning, or for which the meaning is obscure. The brain is designed to perceive patterns and connections, and it resists having meaningless patterns of knowledge imposed upon it. A system of teaching based upon rewards, punishment, narrowly preconceived results, and time limits may cause students to downshift in the use of their brains (Parnell, 1985).

In 1998, the University of Georgia received funds from the U. S. Department of Education to develop a model of excellence for contextual teaching and learning in preservice teacher education. After five years of study, research revealed that there are significant benefits to using contextual teaching in the classroom. Ninety-four percent of the students said that they learned a lot more in the contextual learning classes than in traditional courses. Once students see real world relevance of what they are learning, they become more interested and motivated (Predmore, 2004).

Carraher, Carraher, and Schliemann (1985) studied everyday math skill in the street markets of Recife, Brazil. Children in the street markets made accurate complex calculations; however, when asked the same questions in a decontextaulized formal way, the children could not make the calculations. In the formal situation children were required to work with abstract symbols, but in the natural setting they made calculations using quantities. In another study by Carraher, Carraher, and Schliemann (1987), construction workers and eighth grade students solved scale problems on architectural drawings. The construction workers out performed the students even though all the students were knowledgeable of the proportion algorithm used to solve the problem (Lave, 1988).

Palinscar, Brown, and Newman (1984) developed a teaching method to improve reading comprehension called reciprocal teaching. Reciprocal teaching is a contextual model of instruction where the teacher and student take turns leading a dialogue concerning sections of text. Studies document that reciprocal teaching is effective and student outcomes are enhanced. In addition, students transfer reading comprehension to other subject areas. Another contextually teaching model is anchored instruction, which was developed at Vanderbilt University. Anchored instruction provides a meaningful context for learning by creating problem-solving situations that approximate real life situations. Anchored instruction uses a model for the creation of problem contexts. This method enables students to see how and understand under what conditions knowledge is used. Students participating in anchored instruction demonstrated superior performance on word problems and planning problems (Karweit, 1998).

In 1992, Pepple and O'Connor conducted a study for the National Center for Research in Education (NCRVE) of applied communications and applied mathematics curriculum. The study results concluded that the applied mathematics curriculum materials enable students to perform at higher academic levels in mathematics (Stasz et al., 1995). In addition Pepple and O'Connor found gains in student achievement for students enrolled in applied academics courses. A study conducted by Crain and colleagues examined 133 career magnet programs in New York City. The study indicated several positive student outcomes, such as lower school drop out rates, lower absenteeism, improvements in reading and math, and increased progress toward graduation (Heebner, Crain, Keifer, & Si, 1992). Burchett (1995) cited that a positive attitude is a predictor of improved math performance; students enrolled in applied mathematics courses had better attitudes than those enrolled in other math courses, especially lower socioeconomic students.

A study conducted by Wallace (1996) indicated that remedial study at the technical college was related to the high school program of students. Tech-prep students required less remediation in reading, writing, and mathematics than students in general education programs. Tech-prep legislation since its inception has included the term applied academics. Legislative initiatives for tech-prep, including the Carl D. Perkins Act Amendments of 1990 and 1998 and the School-to-Work Opportunities Act of 1994, have addressed the need for contextual curriculum and work-based learning opportunities (Dare, 2000). Through contextual learning, students are able to discover meaningful relationships between abstract ideas and practical applications in the context of the real world.

The tech-prep program contains seven essential elements which provide a general template for tech-prep planning and implementation at state and local levels. By understanding the intent of each element, a conceptual schema is assumed where implementation and student outcomes can be assessed (Bragg, Loeb, Gong, Deng, Yoo, and Hill, 2002). Ultimately, Perkins should be judged in terms of outcomes (Stecher, Hanser, Hallmark, Rahn, Levesque, Hoachlander, et al., 1994). The seven elements as defined by Perkins law include:

(1) articulation agreements between secondary and postsecondary consortium participants,
(2) 2+2, 3+2, or a 4+2 design with a common core of proficiency in math, science, communication, and technology,
(3) specifically developed tech-prep curriculum,
(4) joint in-service training of secondary and postsecondary teachers to implement the tech-prep curriculum correctly,
(5) training of counselors to recruit students and to ensure program completion and appropriate employment,
(6) equal access of special populations to the full range of tech-prep programs,
(7) and preparatory services such as recruitment, career and personal counseling, and occupational assessment (U.S. Department of Education, 2006).

Perkins legislation outlines the expected student outcomes of tech-prep which include:

(1) associate degree or a 2-year certificate,
(2) technical preparation in at least one field of engineering, technology, applied science, mechanical, industrial, or practical art or trade, or agriculture, health or business,

(3) competence in math, science, and communication,

(4) and employment (U.S. Department of Education, 2006).

By using the tech-prep program outline as a conceptual framework, it was possible to link tech-prep standards or elements and expected outcomes. The implementation of Perkins performance measures and standards should be judged in terms of student outcomes (Stecher et al., 1994). Gray (1999) notes that traditional outcome assessment measures still dominate the criteria used to evaluate the effectiveness of career and technical education programs. A framework in career and technical education must include performance indicators that examine legislative mandates and underlying philosophy, as well as specific outcomes, practices, and inputs (Rojewski, 2002). The tech-prep program at the high school level is the foundation for students to reach a student outcome at the postsecondary level. With proper implementation of the tech-prep program through the use of contextual learning theory and integrated academic and career technical education, students should be able to reach a student outcome as outlined by Perkins legislation. Because tech-prep creates a constructivist learning environment that follows a cognitive model of teaching and learning that integrates practical applications into academics, results from this study can be interpreted through the use of outcomes of tech-prep and non tech-prep students as defined by Perkins legislation.

Research Design

Causal-comparative designs allow researchers to describe conditions that have already occurred and study them in retrospect (Frankel & Wallen, 1996). Causal-comparative research is referred to as ex post facto research, which means after the fact. A researcher is exploring a suspected cause of a condition that already exists (Charles & Mertler, 2002). Causal-comparative studies are nonexperimental investigations in which researchers try to identify cause-and-effect relationships, by forming groups of individuals in whom the independent variable is present or absent and then determining if the groups differ on the dependent variable (Gall, Gall, & Borg, 2003). Causal-comparative research is done to explore a possible cause and effect. The independent variable is not manipulated. Research focuses first on the effect and then attempts to determine the cause of the observed effect. The basic question it explores is “What is causing the observed effect?” Causal-comparative research focuses on the effect, hypothesizes a cause, and makes a logical connection that suggests the observed effect is being influenced by the hypothesized cause (Charles & Mertler). This study will be a causal-comparative study that attempts to describe tech-prep participants and identify a cause-and-effect relationship between tech-prep and student outcomes.

The goal of a researcher is to provide full experimental control or use a true experimental design; however, in educational research it is often hard to conduct such an experiment. In this case, researchers would turn to designs where they can have as much control as possible under existing situations. These designs are known as quasi-experimental designs and are used when true experimental designs are not feasible. Because this design does not provide full control, it is extremely important that a researcher know which variables in his or her design may be inadequately controlled. It is imperative that the researcher be aware of both internal and external validity and consider these in interpretations (Ary, Jacobs, & Razavieh, 1972). Causal-comparative research designs can be reconceptualized as a correlation research design by changing how the variables are measured and analyzed. Correlational research designs refer to studies in which the purpose is to discover relationships between variables through the use of correlational statistics (Gall et al., 2003). The data for this study will be collected after the fact; therefore, it will not be a true experiment. It is pertinent that extraneous variables be controlled.

After the research problem has been stated in causal-comparative research, a group that possesses the characteristics a researcher wishes to study should be defined. The definition should be precise so that results of the study can be meaningfully interpreted. At this point, a researcher should select a group not having the characteristics or having them at a lesser degree. If a researcher finds that two groups differ significantly on an extraneous variable, matching can be used to equate the two groups so that extraneous variables do not confound the study. Data can be collected from a variety of instruments. The first step to data analysis is to conduct an exploratory data analysis to compute descriptive statistics for each comparison group. The next step is to conduct a test of statistical significance (Gall et al., 2003). In this study, tech-prep was clearly defined in order to interpret results, and descriptive statistics were conducted for both tech-prep and non tech-prep participants.

Advantages of the causal-comparative method are that cause-and-effect relationships can be studied in situations where manipulation is not possible and many relationships can be studied in a single research project. Another advantage is that virtually any type of measurement instrument can be used (Gall et al., 2003). Also, Cook and Campbell (1979) claim that it is possible to draw strong conclusions from this type of research if all the threats to validity are accounted for and considered. In this study, Asset test scores and successful completion rates were used to determine student outcomes for tech-prep.

A disadvantage of causal-comparative research designs is that inferences about causality on the basis of collected data are necessarily tentative. Other disadvantages are that it is difficult to establish causality and that competing or alternative hypotheses often cannot be ruled out (Gall et al., 2003). Randomized assignment of participants to groups is ideal, but is often not possible. If randomization is not possible, every effort must be made to show that the groups are equivalent at the beginning of the study. The most common method of providing control has been to match participants on as many extraneous variables as possible, but in order to utilize matching; a researcher must know the relevant factors. Furthermore, matching is likely to reduce the number of participants. A superior method of control would involve the use of analysis of covariance, which permits a compensation to be made for the lack of equivalency in the groups initially. Precision is attained without having the problems of matching. The relevant variables are used as covariates in a multiple-covariate design. Researchers must rule out the influence of all variables that may have a plausible alternative explanation for the one they are proposing (Ary et al., 1972). For this study, randomization is not available, but an analysis of covariance could have been used as a statistical test to help control for extraneous variables. In order to do this, it would be necessary to identify a variable that would possibly neutralize pre-existing differences. No pre-existing variable was available for the data set.

In addition to randomization, matching, and analysis of covariance, stating and testing alternative hypotheses could rule out influences of other variables (Ary et al., 1972). The researcher should attempt to state and test alternative hypotheses about other factors that might explain observed differences. Testing plausible alternative hypotheses is called strong inference. Theory can help to determine possible variables that might explain the phenomena. This is preferred to the shotgun approach, which involves administering a large number of measures because they are interesting or available (Gall et al., 2003).

Internal validity is the extent to which extraneous variables have been controlled by the researcher. An extraneous variable is any variable other than the treatment variable that, if not controlled, can affect the experimental outcome (Gall et al., 2003). Anything affecting the controls of a design becomes a problem with internal validity (Kerlinger & Lee, 2000). Campbell and Stanley (1963) identified eight; Cook and Campbell (1979) expanded this list to twelve types of extraneous variables that can affect the results of experiments: 1) history, 2) maturation, 3) testing, 4) instrumentation, 5) statistical regression, 6) differential selection, 7) experimental mortality, 8) selection-maturation interaction, 9) experimental treatment diffusion, 10) compensatory rivalry by the control group, 11) compensatory equalization of treatments, and 12) resentful demoralization of the control group. Internal validity is not applicable to descriptive research because it does not seek to identify causal patterns in phenomena. In this study, there was a threat to internal validity because other factors may have influenced student outcomes. Using multiple independent variables and demographic data helped to minimize this threat to internal validity. In addition, an effort was made to establish equalization of tech-prep and non tech-prep students at the beginning of the study, but no appropriate variable was available.

External validity is the extent to which the findings of an experiment can be applied to individuals and settings beyond those that were studied. Population validity concerns the extent to which the results of an experiment can be generalized from the sample that was studied to a specified, larger group (Gall et al., 2003). External validity defines representatives or generalizability (Kerlinger & Lee, 2000). Campbell and Stanley (1963) present four threats to external validity: 1) reactive or interaction effects of testing, 2) the interaction effects of selection biases and the independent variable, 3) reactive effects of experimental arrangements, and 4) multiple-treatment interference. Overall validity of a study is strengthened if the researcher presents a strong chain of evidence that makes clear, meaningful links between research questions, raw data, and findings (Gall et al.). The sample for this study will be high school graduates in 2002 or 2003 that entered CVTC in 2003. Due to geographical limits, information constraints, research interests, and time concerns, a convenience sample was used. Convenience sampling allowed for participants who meet specific criteria to be identified and included in the study. The constraint of the convenience sample was that the generalizability of results was limited.

Variables

In causal-comparative research designs, which attempt to explain education phenomena through the study of cause-and-effect relationships, variables can be independent or dependent. Independent variables are the presumed cause and dependent variables are the presumed effect (Gall et al., 2003). The independent variable is the antecedent; the dependent variable is the consequent. Looking at the relationship between independent variables can uncover relations between different phenomena. The independent variable is assumed to influence the dependent variable. The independent is the variable manipulated by the researcher. The dependent variable is the outcome measure that the researcher uses to determine if changes in the independent variable had an effect (Kerlinger & Lee, 2000). In research studies, the dependent variable is the phenomenon that is the object of study and investigation (Ary et al., 1972). For the purpose of this study the dependent variable was remediation rates (Asset test scores) and successful completion rates from technical college programs. The major independent variable was high school curriculum (tech-prep or non tech-prep).

In research, some characteristics exist where the researcher is not able to manipulate the variable. Attribute variables cannot be manipulated. Gender is an example of an attribute variable (Kerlinger & Lee, 2000). Attribute variables, also known as assigned or organismic variables, can be used by researchers to assign participants to groups on the basis of these preexisting variables (Ary et al., 1972). Manipulated variables are called active variables. Manipulation means doing different things to different groups of participants, for example, if a researcher has two groups follow different instructions or if a researcher does one thing to one group and something different to the other group. In casual-comparative research, researchers study participants after manipulation could have occurred; therefore, researchers inherit variables (Kerlinger & Lee). Other independent variables or attribute variables for this study were gender, minority status, and technical college program pursued.

In research planning, the distinction and analysis of variables, as continuous or categorical, must be determined. Continuous variables are capable of taking on an ordered set of values (Kerlinger & Lee, 2000). Values are located on a continuum, ranging from high to low levels of the variable. There is an indefinite number of point values that can occur. In practice, continuous scores are usually limited to whole numbers, but in theory, factorial scores must be computed to consider a variable continuous. Raw scores are difficult to interpret; often, they are converted to derived scores to aid for interpretation by providing a quantitative measure relative to a comparison group (Gall et al., 2003). Categorical variables are nominal measures where there are two or more subsets of the group of objects being measured. To categorize means to assign one object to a subclass of a class on the basis of the object having or not having characteristics that define the subset All the members of a subset are assigned the same name and the same numeral (Kerlinger & Lee). Category refers to values that can yield two or more discrete, noncontinuous scores. Dichotomy refers to a categorical variable that has only two values. Artificial dichotomy results when individuals are placed into two categories on the basis of performance on a continuous variable, i.e., pass or fail (Gall et al.). All variables used in this study will be categorical except Asset test scores which will be continuous.

Conceptualization and Treatment of Variables

When using archival data, as with this study, researchers are using a nonexperimental design. Researchers will study phenomena, as they exist; variables cannot be manipulated. Variables should be selected to be a quantitative expression of the construct. The research design must be constructed by purpose. Educational research is conducted for four primary purposes: description, prediction, improvement, and explanation. If researchers attempt to explain educational phenomena, they should, if possible, frame their explanations as theories about the phenomena being investigated. The construct in theory development is a concept that refers to a structure or process that is hypothesized to underlie particular observable phenomena. Theory-based research has several advantages because it yields important results, adds knowledge needed for the advancement of a science of education, and provides a rational basis for explaining or interpreting the results of a study (Gall et al., 2003). This study was based on outcomes as defined by Perkins legislation, and results were interpreted using tech-prep as a cognitive, constructive model of teaching that incorporates contextual teaching and learning and integrated academic and career and technical education.

In a study conducted by Stull (2002), archival data from NELS:88 was used to investigate determinants of achievement in minority and nonminority students. The dependent variable or construct of the study was achievement. The independent variables were chosen based on research about achievement and the purpose of the study. The sample was given parameters by looking only at 8th grade students. Several problems that exist when working with large archival data sets, such as High School and Beyond (HS&B) and the 1988 National Educational Longitudinal Study, are that the data set typically does not include the exact items or variables that a researcher desires. When working with archival data in nonexperimental designs, it is important to choose variables that will measure the construct and fit the research purpose. In addition, a researcher must set clear parameters for the data collection (Strein, 1993). Clear parameters as outlined above were used for this study.

Rationale for Tech-Prep Education

In past decades, Americans with a solid work ethic and some work-related training could fare relatively well in the economy, even if they possessed low academic skills. Jobs requiring low- to medium-level skills were plentiful, and most paid sufficient wages to support a family. However, the number of low-skilled positions in the U.S. is declining, and the fastest-growing jobs in the U.S. economy require some form of postsecondary education (D'Amico, 2003). For example, in the U.S. over 65% of all occupations require advanced skill training beyond high school, but less than a four-year baccalaureate degree. In addition, 90% of the fastest growing occupations require some career and technical education; many of these are health- or computer-related (U.S. Bureau of Labor Statistics, 2006).

The shift in the labor market, from low- to high-level skills, has fueled educational reform efforts over the past three decades due, in part, to strong economic competition felt from around the globe. Fifteen years after the initial implementation of tech-prep, through funding provided by the Carl D. Perkins Vocational and Applied Technology Education Act of 1990, the demand for a workforce with academic and career and technical skills is still growing. Roughly 47% of high schools in the United States offer tech-prep curriculum to students (U.S. Department of Education, 2006). In 1995, the National Tech-prep Evaluation found that 70% of school districts that serviced 90% of all high school students reported they offered tech-prep programs for a total enrollment of 737,635 students (Hershey, Silverberg, Owen, & Hulsey, 1998).

By the year 2020, jobs that require postsecondary education are expected to increase by 22%. This will require that 12 million people receive additional training beyond high school. A large portion of these people will require additional education to support the needs of the new diversified workforce. In Georgia, 40% of ninth grade students dropout of school. Also, about one-fourth of college freshmen dropout of school, and one-half of community college students fail to complete a second year of school (Commission for a New Georgia, 2004). In today's global economy, it is crucial that America's high school students have the sufficient basic skills in English, reading, math, and science, in addition to higher level thinking, reasoning, communication, and problem-solving skills. Employers estimate that 39% of high school students entering the labor market are unprepared for entry-level jobs and that almost 60% of jobs in today's workforce require postsecondary training. These numbers reiterate the fact that changes must be made at the high school level to encourage students to stay in school and obtain basic skills (2005 Education Summit on High Schools, 2005).

According to Cohen and Brawer (1996), over 30% of all college students in the U. S. live near a community college system; therefore, articulated programs of study such as tech-prep make sense. Another positive aspect of tech-prep is the support it has received from business and industry. Businesses help in youth apprenticeship and/or worksite learning and also provide career speakers and classroom instructors. In addition, businesses provide facility tours and other career awareness events, help to develop curriculum, define desired outcomes, and support staff development (Brown, 1998a).

Tech-prep programs extend between secondary and postsecondary institutions and follow a variety of articulated program pathways, such as 2 + 2 (grades 11-14), 4 + 2 (grades 9-14), 2 + 2 + 2 (grades 11-16) or 2 + 2 (grades 11-14) apprenticeship framework (Craig, 1999). The 2 + 2 framework starts at grade 11 with tech-prep courses and continues with articulated courses in grade 12. At the postsecondary level, students would complete an Associate degree in two years and then enter the workforce or pursue a BS or BA degree. The 4 + 2 model starts in grades 9 and 10 where students begin applied academics. In grade 11 students take tech-prep courses and continue with articulated courses in grade 12. This model ultimately leads to completion of an Associate degree and then employment. The 2 + 2 + 2 framework begins in grade 11 with tech-prep courses and continues with articulated courses in grade 12. This framework is designed to lead to a BS or BA degree and then employment. The 2 + 2 apprenticeship framework is similar to the 2 + 2 framework, but replaces articulated courses with work-based experience (Craig, 1999).

The federal definition of tech-prep education is a 4 + 2, 3 + 2, or 2 + 2 planned sequence of study in a technical field beginning as early as grade 9. The sequence extends through two years of postsecondary education or through an apprenticeship program of at least two years following secondary instruction and culminating in an Associates degree or certificate (National Tech Prep Network, 2006). According to the Georgia Department of Education (2006), a secondary tech-prep student is a high school junior or senior that has completed two or more technology-career courses from a tech-prep career major/path that has been identified as aligning with a postsecondary program leading to a postsecondary credential. A secondary completer will be identified according to these requirements as well as graduating with a tech-prep diploma. A tech-prep completer is a student who has successfully completed the secondary and postsecondary requirements of an aligned-articulated tech-prep career major (program of study), resulting in a postsecondary Associates degree, diploma, or certificate.

Tech-prep programs use time and resources that are designed to prepare students for postsecondary education, but between 30-90% of freshmen entering two-year postsecondary education need remedial reading, writing, or mathematics courses (Perin, 2002). Tech-prep is also designed to prepare students for highly skilled technical occupations, but employers complain that employees lack basic skills such as reading, writing, and mathematics (Rosenbaum, 2001). It is imperative to collect and analyze data to hold tech-prep programs accountable at the local, state, and federal level. Tech-prep must demonstrate its contribution to student achievement, program completion, and placement in postsecondary education and the workforce (Hoachlander, 1999). Data is needed to show the effectiveness of tech-prep in order for it to continue in the future (National Tech Prep Network, 2006). However, to date, the collection and analysis of tech-prep data at the local, state, and federal levels has been minimal. Only a small percentage of tech-prep programs are implementing formal evaluations, and most of these are in the preliminary stages (Ruland & Timms, 2001).

Past research on outcomes of tech-prep participants has focused primarily on student outcomes at the secondary level (e.g., Atkinson, 1996; Bragg, Layton, & Hammons, 1994; Brown, 2000; Fellers, 1994; Grubb, Badway, Bell, & Kraskouskas, 1996; Hershey, Silverberg, & Owen, 1995; Hershey et al., 1998; Klimbal, 1996). Student outcomes are typically measured by high school drop-out rates, graduation test scores, grade point averages, attrition rates, Asset test scores, licensure passing rates, or intent to pursue postsecondary education. However, much of the research is limited or inconclusive due to poor identification of tech-prep participants. Oswald (2002) provided evidence that tech-prep participants had higher levels of attendance and were more likely to gain credits toward graduation, but student identification and implementation was an issue.

Positive results for tech-prep programs were found in a study by Bragg et al. (2002) where tech-prep participants were much more likely to have a vocational concentration and enroll in postsecondary education, but implementation of the tech-prep model was a factor in the results. Completion of a college degree or certificate was not a common occurrence for tech-prep or non tech-prep participants. Family income and parental education was somewhat lower for tech-prep participants, suggesting that tech-prep participants lack cultural capital (Labaree, 1997). Tech-prep participants display some classic characteristics, such as first generation college and low-income homes that are usually associated with at-risk behavior at the college level. This could jeopardize their ability to transition to or persist in college (Tinto, 1996).

Rhode Island conducted a formative evaluation of its tech-prep program. Results of the study indicated positive effects for its participants. Tech-prep students had significantly higher grade point averages than non tech-prep students. In addition, a majority of tech-prep students reported that tech-prep had influenced or prepared them for their postsecondary plans. No significant differences were found at the postsecondary level with regard to GPA, but a possible explanation is that tech-prep students did not take full advantage of academic advising or support services (MacQueen, 1995).

Parkhill (1998) conducted a study in North Carolina, which compared tech-prep, college-prep and general-prep students. Results found a relationship between tech-prep and positive student outcomes at the postsecondary level. Tech-prep students were more likely to have a career path, as compared to general- or college-prep, but completion rates were low for all three groups. Although college-prep students had significantly higher Asset test scores upon entry, no differences existed between the two groups' GPAs. High school graduates from both tracks were adequately prepared to progress through post-secondary education. In a study by Krile and

Parmer (2002) students who participated in the tech-prep program had positive results at the college level. Tech-prep participants had higher entry assessment scores and were less likely to need remedial mathematics. Also, tech-prep participants were more likely to be retained one year after their initial term of entry.

Sweat and Fenster (2006) used archival data from the Georgia Department of Technical and Adult Education (GDTAE) to conduct a study that examined Asset test scores, grade-point averages (GPAs), and speed of graduation of tech-prep students. The study found no essential differences between tech-prep and non tech-prep students on Asset test scores or GPAs. Although many tech-prep and non tech-prep students did not complete their programs in the standard amount of time, tech-prep students did complete their studies faster than non tech-prep. The study found that tech-prep students were receiving articulated credit, which could account for the faster completion.

A study conducted by Hodges (1998) examined the large number of high-risk students at Chattahoochee Technical Institute in Marietta, GA, who were placed in remedial education courses. Students were successfully completing developmental courses, but the study reported that high-risk students were more likely to drop out of the institute than students placed directly into regular courses. Improving retention is a major priority of the institution.

Student populations at community and technical colleges must overcome a variety of environmental and demographic factors. Community and technical colleges attract high proportions of students from lower socioeconomic groups. Geographic access and convenience are often barriers for students who wish to pursue education at the postsecondary level (Lynch, 1994). Many community and technical colleges serve a very diverse student population, which consists of high-risk students under prepared for college studies (Smittle, 1995).

Tech-prep programs in Georgia serve a population that reported in 2004-2005 around a 60% graduation rate for high school students. Of these graduates only 61% were eligible to receive the HOPE scholarship (Governor's Office of Student Achievement, 2005). The Georgia Student and Finance Commission set certain criteria for students seeking financial aid from the HOPE scholarship. Any student who graduated from high school in 1993 or later as a HOPE Scholar graduate, who maintained a B average, can qualify for a degree program as an entering freshman in an eligible public college in Georgia. All Georgia residents are eligible for the HOPE grant. To qualify for the HOPE grant, the certificate or diploma program must be approved by the Georgia Department of Technical and Adult Education. Much like the HOPE scholarship, the HOPE grant provides full tuition and book allowance. There is no minimum grade point average to be a HOPE grant recipient. The HOPE grant will only pay for a maximum of 63 semester or 95 quarter hours of study. Students are encouraged to perform their best, if they later wish to pursue a diploma and receive the HOPE scholarship (Georgia Student Finance Commission, 2006). Many tech-prep students rely on HOPE funding for postsecondary education.

In 2004-2005, Coosa Valley Technical College had a 28.8% completion rate for Associate degree or diploma programs. Certificate programs had a higher completion rate with 38.6%. The retention rate was reported at 46.6% (Governor's Office of Student Achievement, 2005). With tech-prep, cooperation between secondary and postsecondary schools is a major issue. Project REAL was created by Coosa Valley Technical College and the five school systems served by CVTC to better inform high school students about career opportunities available through technical education. REAL is an acronym for Relevant Education and Life and is an effort to emphasize to young people the relationship between what they are learning in school and the skills they will need for their career choice beyond high school. Career transition specialists are placed in each school system as a liaison (Coosa Valley Technical College, 2004). This program could have positive effects on expected student outcomes, but the low completion and retention rates could have adverse affects on tech-prep student outcomes at Coosa Valley Technical College.

A major issue affecting tech-prep is its identity crisis. The original intent of tech-prep was to reform the education system by developing new pathways for students to better meet the needs of the twenty-first century workplace, as well as to introduce methods of teaching that would make education more meaningful for students. Legislation called for a series of elements that would ultimately change career and technical education, but they were quite broad in scope. An insufficient amount of funds was budgeted to accomplish this purpose. Because of the flexibility of tech-prep at the state and local level, it is hard to define secondary and postsecondary tech-prep students (Barnett, 2002). Reporting methods of tech-prep differ from school to school and level to level (Jacobs, 2000). Tech-prep can play an important role in school reform, but there remains a need to combine all the elements of tech-prep into a comprehensive career-focused, structured program of study (Brown, 1998a).

Without support and funding, tech-prep programs may slowly fade, leading to the return of the general track diploma. Parents and students often balk at strictly defined sequences of courses explicitly preparing students for postsecondary education at a local community college (Hershey et al., 1998). Community colleges lack confidence that high school courses are equivalent to postsecondary courses (Urquiola, Stern, Horn, Dornsife, Chi, Williams, et al., 1997). Support from parents, students, education, and community and funding from the local, state and federal level are vital components of tech-prep. With current proposed legislation, tech-prep could stand to lose substantial funding. Career and technical education could possibly lose $1.3 billion in federal funding if the Carl D. Perkins Vocational and Technical Education Act is eliminated (Hyslop, 2006). With state and federal governments pushing for accountability in preparing all students, tech-prep provides a foundational network to establish effective programs; however, funding and support are needed for this to be accomplished (Craig, 1999).

Tech-prep has guided most of the effective partnerships seeking change in efforts to improve education for average students over the last twenty years. During its first 12 years (1990-2002) tech-prep was effective in: (a) creating secondary and postsecondary articulation agreements, (b) providing opportunities for students to earn advanced credits in high school, (c) developing advanced skills curricula for Associate degrees, (d) improving academic achievement through contextual teaching, e)integrating academic and technical courses, and (f) increasing graduation rates (Hull, 2004).

Tech-prep can lead the way for the next wave of educational change. This study helped determine if tech-prep students are reaching the expected outcomes. Tech-prep can be used as a building block and change agent for career pathways in the future. The next generation of tech prep, career pathways, can benefit from the findings in this study. This study can help Georgia adapt existing programs such as tech-prep to meet the educational and workforce demands of the future.

CHAPTER 3

METHOD

Design

The purpose of this study was to explore selected outcomes, measured by a need for academic remediation and successful completion of tech-prep and non tech-prep students enrolled in 2-year postsecondary technical colleges using a casual-comparative design. Causal-comparative designs allow researchers to describe conditions that have already occurred and study them in retrospect (Frankel & Wallen, 1996). Causal-comparative research is referred to as *ex post facto* research, meaning collecting data after the fact. The design forms groups of individuals in whom an independent variable is present or absent and then determines if groups differ on a dependent variable (Gall, Gall, & Borg, 2003). In this study, differences in academic remediation and successful completion of technical college students completing either a tech-prep or non-tech-prep secondary education curriculum were determined.

Causal-comparative research explores possible cause and effect relationships, but does not manipulate an independent variable. Research focuses first on an effect and then attempts to determine a cause of the observed effect. The basic question it explores is, “What is causing the observed effect?” Causal-comparative research focuses on the effect, hypothesizes a cause, and makes a logical connection that suggests the observed effect is being influenced by the hypothesized cause (Charles & Mertler, 2002). This study was a causal-comparative study that attempted to describe tech-prep participants and identify a cause-and-effect relationship between participation in secondary tech-prep programming and 2-year postsecondary student outcomes.

In cases where experimental control is not possible, researchers turn to designs where they have as much control as possible under existing situations. These designs are known as quasi-experimental designs which include casual-comparative designs. Because causal comparative designs do not provide full control, it is extremely important to identify variables that may be inadequately controlled and influence the dependent variable. It is imperative that researchers are aware of both internal and external design validity issues and consider these in interpretations (Ary, Jacobs, & Razavieh, 1972). For this study, extraneous variables were controlled by setting clear parameters for the definition of tech-prep, clearly defining the research focus to include academic remediation and successful completion of 2-year postsecondary education students, and using multiple independent variables including gender, minority status, and type of technical college program pursued.

In a causal-comparative research design, group definition should be precise so that results can be meaningfully interpreted. In addition, a group not having the defined characteristics or having it to a lesser degree should also be identified. Data can be collected from a variety of instruments. The first step in data analysis is to compute descriptive statistics for each of these groups. The next step is to conduct a test of statistical significance (Gall et al., 2003).

In this study, tech-prep was defined using the Coosa Valley Area Tech-Prep Consortium (2006) definition in order to best interpret results. Tech-prep was defined as a nationwide career development system that provides students with a planned program of study that incorporates academic and career-related courses articulated between the secondary and postsecondary levels leading to a diploma, degree, or two-year apprenticeship certificate. A secondary tech-prep student was a high school junior or senior that had completed two or more technology or career courses that have been identified in the state database as aligning with a postsecondary program leading to a postsecondary credential. A postsecondary tech-prep student was a student who had transitioned from high school to postsecondary education with a tech-prep program of study instructional plan derived from a signed tech-prep articulation agreement between the secondary school system and the postsecondary institution. A tech-prep completer was a student who had successfully completed the secondary and postsecondary requirements of an articulated tech-prep program of study, resulting in a postsecondary Associate degree, diploma, or a certificate.. Advantages of the causal-comparative method are that cause-and-effect relationships can be studied in situations where manipulation is not possible, and many relationships can be studied in a single research project. Another advantage is that virtually any type of measurement instrument can be used (Gall et al., 2003). Cook and Campbell (1979) claim that it is possible to draw strong conclusions from this type of research if all the threats to validity are accounted for and considered. In this study, Asset test scores and successful completion rates were used to determine student outcomes. The Asset test is actually a series of short placement tests developed by American College Testing (ACT, 2005). Asset test scores indicate areas in which a student is strong and areas where help is needed. The Asset test consists of four sections: writing, reading, numeric, and elementary algebra. Successful completion was determined by the granting of a diploma, technical certificate, or Associate of Applied Science program degree.

A disadvantage of a causal-comparative research design is that inferences about causality on the basis of collected data are necessarily tentative. Specifically, it is difficult to establish causality, and competing or alternative hypotheses are hard to rule out entirely (Gall et al., 2003). While randomized assignment of participants to groups is ideal, this approach was not possible in the current study. Because randomization was not possible, every effort was made to show that the groups were equivalent at the beginning of the study.

Internal design validity is the extent to which extraneous variables have been controlled. An extraneous variable is any variable other than the treatment variable that, if not controlled, could affect the experimental outcome (Gall et al., 2003). Campbell and Stanley (1963) initially identified eight potential threats to internal validity, while Cook and Campbell (1979) expanded this list to 12 types. These threats include: (a) history, (b) maturation, (c) testing, (d) instrumentation, (e) statistical regression, (f) differential selection, (g) experimental mortality, (h) selection-maturation interaction, (i) experimental treatment diffusion, (j) compensatory rivalry by the control group, (k) compensatory equalization of treatments, and (l) resentful demoralization of the control group. In this study, factors other than those identified may have influenced student outcomes, such as socioeconomic status, and environmental elements (economic, political, legal, social, cultural, and technological). Using multiple independent variables and demographic data helped to minimize this threat.

External design validity is the extent to which the findings of an experiment can be applied to individuals and settings beyond those studied, i.e., representativeness or generalizability (Gall et al., 2003; Kerlinger & Lee, 2000). Campbell and Stanley (1963) presented four threats to external validity: (a) reaction or interaction effects of testing, (b) the interaction effects of selection biases and the independent variable, (c) reactive effects of experimental arrangements, and (d) multiple-treatment interference. The sample for this study included 2002 and 2003 high school graduates that entered Coosa Valley Technical College in 2003. Due to geographical limits, information constraints, research interests, access, and time concerns, a convenience sample was used. Convenience sampling allow for participants who meet specific criteria to be identified and included in the study. The constraint of a convenience sample was that the generalizability of results was limited.

Data collected included information already compiled while participants were in their first two years at Coosa Valley Technical College, a 2-year technical college in northwest Georgia. Specific data collected to reflect student outcomes included Asset test scores and indicators of successful completion. Data was collected from the Georgia technical college database system, Banner, managed by Coosa Valley Technical College. The registrar at Coosa Valley Technical College accessed and prepared the data for this study.

Participants

The sample for this study was 173 high school graduates from 2002 and 2003 who entered Coosa Valley Technical College in the fall, winter, spring, or summer quarters during 2003. Completion status was determined as of December 2005 to give students sufficient time to complete a diploma, technical certificate, or Associates degree. Coosa Valley Technical College is a member of Georgia's system of technical colleges that operate under the Georgia Department of Technical and Adult Education, and provides occupational education, skills training, and workforce development to support the educational, economic, and community development of surrounding counties (Coosa Valley Technical College, 2005a). In the past two years, Coosa Valley Technical College's student enrollment totaled around 3,000 students for its three campuses in Floyd, Gordon, and Polk counties (Coosa Valley Technical College, 2005b).

The two groups of this study were tech-prep and non tech-prep students. Tech-prep students were defined using the local Coosa Valley Tech Prep Consortium definition (Coosa Valley Area Tech Prep, 2006). A tech-prep student was a high school junior or senior that had completed two or more technology or career courses that have been identified in the state database as aligning with a postsecondary program leading to a postsecondary credential. Descriptive statistics were collected as an aid for interpretation of results. Descriptive statistics included gender, minority status, and type of technical college program pursued. Types of technical college programs included diploma, technical certificate, or Associates degree. Minority status was measured as non-minority (white) and minority due to the small enrollment of minority students at Coosa Valley Technical College.

Coosa Valley Technical College had articulation agreements with five school systems, Calhoun City, Floyd, Gordon, Polk, and Rome City. Within these school systems there were 10 high schools. Each high school sends representatives from each curriculum area every year to establish new and maintain current articulation agreements. The articulation agreements allow secondary graduates to receive credit at CVTC for certain courses completed at the high school level. To receive tech prep credit at CVTC, a student must meet admissions requirements and have a properly completed Tech Prep Agreement. In addition to articulation agreements, CVTC employs Career Transition Specialists in each secondary school which assists students in the transition to post-secondary education.

Instrumentation

Data was collected from the Georgia technical college database system, Banner, managed by Coosa Valley Technical College. The database supplied Asset test scores, program completion status, gender, and minority status of students who entered during the 2003 calendar year. The Tech-Prep Coordinator from Coosa Valley Technical College used the database to archive the needed information.

Need for remediation was determined by scores from the Asset test, a placement test widely used by technical colleges, which assists college staff in guiding students toward classes that strengthen and build logically upon their current knowledge and skills. The Asset test is a series of short placement tests developed by the American College Testing Program (ACT, 2005). Asset test scores indicate academic areas where students are strong and where they need help. The Asset test consists of four sections—writing, reading, numeric, and elementary algebra—and is administered prior to enrollment in technical college courses. Results of Asset tests are listed as scaled scores ranging from 23 to 55.

The Asset system has been tested for reliability and validity. Estimates for reliability range from .73 to .88. The American College Testing Program used validity indices generated from logistic regression models and distribution of scaled scores to determine placement effectiveness (ACT, 2005). Coosa Valley uses the cutoffs scores indicated in Table 3.1 to determine student placement.

The Asset writing skills test is a 36-item, 25 minute test measuring understanding of standard written English. The test consists of three prose passages, each accompanied by a sequence of multiple-choice questions. Elements of the writing skills test include punctuation, grammar, sentence structure, organization, strategy, and style. Students are not tested on spelling, vocabulary, and rules of grammar (ACT, 2005). The Asset writing skills test uses scaled scores from 23–55. Students scoring below 34 must enroll in remediation courses at Coosa Valley Technical College (Coosa Valley Technical College, 2005c). According to a study of 23 participating institutions by the American College Testing Program (1994), the mean score for students taking the Asset writing skills test was 40.7.

The Asset reading skills test is a 24-item, 25 minute test. The reading skills test measures reading comprehension as a product of skill at inference and reasoning. The test items require that students derive meaning from several tests. One test requires students to determine the explicit meaning of words through context, and the second test requires students to determine implicit meanings and to draw conclusions, comparisons, and generalizations. The test consists of three prose passages of about 375 words each. The reading level is that commonly encountered by a college freshman. Passage topics include fiction, business, and social studies. These are followed by a set of eight multiple-choice questions (ACT, 2005). The Asset reading skills test uses scaled scores from 23-55 with 55 being the highest possible score. Students scoring below 37 must enroll in remediation courses at Coosa Valley Technical College if they plan to pursue any program (Coosa Valley Technical College, 2005c). According to a study of 23 participating institutions by the American College Testing Program (1994), the mean score for students taking the Asset reading skills test was 40.4.

The Asset numerical skills test is a 32-item, 25 minute test. The test is designed to assess numerical skills in performance of operations with whole numbers, decimals, fractions, and basic problem solving skills. Seventy-eight percent of the test is devoted to arithmetic. Twenty-two percent of the test is devoted to pre-algebra. Students may not use calculators on the numerical skills test (ACT, 2005). The Asset numerical skills test uses scaled scores from 23-55 with 55 being the highest possible score. Students scoring below 34 must enroll in remediation courses at Coosa Valley Technical College (Coosa Valley Technical College, 2005c). According to a study of 23 participating institutions by the American College Testing Program (1994), the mean score for students taking the Asset numerical skills test was 40.8.

The scores from the Asset test are used to determine what remedial courses are needed. Scores determine if students must take remedial courses before beginning their program of study. Table 3.1 outlines test score ranges and the remedial courses required for students at Coosa Valley Technical College.

Table 3.1

Coosa Valley Technical College Test Score Requirements

Writing skills		
Diploma/certificate	If score = 23–31	Must enroll in ENG 096, then in ENG 097
	If score = 32–34	Must enroll in ENG 097
Associate degree	If score = 35–55	Enroll in ENG 101/111 Meets requirements for diploma/certificate programs
	If score = 42–55	Enroll in ENG 191 (AAT degree) Meets requirements for Associate degree programs
Reading skills		
Diploma/certificate	If score = 23–37, or < 9.0 on TABE	Must enroll in RDG 097
	If score = 38–55, or ≥ 9.0 on TABE	Meets requirements for diploma/certificate programs
Associate degree	If score = 23–40, or < 10.0 on TABE	Must enroll in RDG 097
	If score = 41–55, or ≥ 10.0 on TABE	Meets requirements for Associate degree programs
Welding–Joining Technology–Carpentry	If score = 23–32, or < 8.0 on TABE	Must enroll in RDG 097
	If score = 33–55, ≥ 8.0 on TABE	Meets requirements for these specific programs.
Numerical skills		
Diploma/certificate	If score = 23–30	Must enroll in MAT 096, then in MAT 097
	If score = 31–34	Must enroll in MAT 097
	If score = 35–55	Enroll in MAT 101/111 Meets requirements for MAT 101/111
Associate degree	If score = 37–55	Meets requirements for MAT 103
	If score = 42–55	Enroll in MAT 191 (AAT Degree) Meets requirements for Associate degree programs

Determination of successful completion was based on student status as of December 31, 2005. Successful completion rate data was categorical (successful, unsuccessful) for each type of program pursued; diploma, technical certificate, or Associate of Applied Science. Coosa Valley Technical College offers three programs of study in Business Technologies, Health Technologies, Industrial Technologies, and Personal/Public Service Technologies. The programs can last from six weeks to two years, and graduates receive a certificate, diploma, or an Associate of Applied Science. Program length depends on the specific field.

Demographic data included gender and minority status. The data for gender was categorical; male or female. Data for minority status was also categorical using only non-minority (White) or minority (any other group) status. These two categories were used because the minority population at Coosa Valley Technical College is low.

Procedure

Permission from the University of Georgia's Institutional Review Board (IRB) was granted by submitting required forms. Coosa Valley Technical College was identified as the cooperating institution. Evidence in the form of correspondence from an authorized official of that institution approving the research proposal is included (see Appendix 127). Data was collected from Coosa Valley Technical College in March, 2008. The anonymity of all information collected from Coosa Valley Technical College was maintained throughout the study. Data used in the study will be retained for a period of three years at which point it will be destroyed per APA guidelines on maintaining research data.

Data Analysis

The basic problem for this study was to determine if secondary tech-prep students differed from non tech-prep students in terms of selected outcomes at the postsecondary technical college level. Variables that were measured included the need for remediation when entering the technical college and successful completion from a technical college program. Demographic data collected included student gender and minority status. Table 3.2 overviews the analysis strategy for each research question.

Table 3.2

Analysis Strategy

Research question	Independent variable(s)	Dependent variable	Statistical procedure
1. What are characteristics of tech-prep and non-tech prep students entering 2-year technical colleges directly from high school in relation to gender, minority status, and type of technical college program pursued?	High school curriculum Tech Prep=0, Non-Tech Prep=1 Gender Male=0, Female=1 Minority status Minority=0, Non-minority=1 Program pursued Diploma=0, Technical certificate=1, Associate of Applied Science degree=2		Descriptive statistics Cross Tabulations
2. Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school differ in the need for remediation (mathematics, reading, and writing) for the different technical college programs pursued (diploma, technical certificate, and Associate of Applied Science)?	High school curriculum Tech Prep=0, Non-Tech Prep=1 Program pursued Diploma=0, Technical certificate=1, Associate of Applied Science degree=2	Remediation rate via Asset Test scores (continuous) Math Reading Writing	(9) 1-way ANOVA
3. Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school have different successful completion rates for each type of technical college program pursued (diploma, technical certificate, and Associate of Applied Science)?	High school curriculum Tech Prep=0, Non-Tech Prep=1 Program pursued Diploma=0, Technical certificate=1, Associate of Applied Science degree=2	Successful completion (categorical) Successful=0, Unsuccessful=1	(3) Chi-square

For each research question, a different statistical procedure was used. For the first question descriptive statistics were used to describe participants' gender, minority status, and type of college program pursued. In addition, cross tabulations of high school curriculum were conducted for gender, minority status, and type of technical college program pursued.

For the second research question, a series of one-way analysis of variance (ANOVA) procedures were used to compare the two groups of students, tech-prep and non tech-prep. ANOVA is a parametric measure that assumes multivariate normality, meaning that samples are drawn from a population that is normally distributed (Kerlinger & Lee, 2000). In an ANOVA, as with a *t*- test, a ratio of observed differences is used to test hypotheses. The *F-ratio* employs the variance of group means as a measure of observed differences among groups. An advantage to ANOVA is that it reduces Type I error, but specificity is lost (Ary et al., 1972).

Key assumptions of ANOVA are that groups formed by the independent variable are relatively equal in size and have similar variances on the dependent variable. Homogeneity of variance assumes that the variances within the groups are statistically the same. Variances are assumed to be homogeneous from group to group, within the bounds of random variation (Kerlinger & Lee, 2000). A one-way ANOVA tests differences in a single interval dependent variable among two or more groups formed by the categories of a single categorical independent variable. A two-way ANOVA analyzes one interval dependent in terms of the categories formed by two independents (Patten, 2002).

In an ANOVA, a significant *F* statistic indicates that there are differences somewhere in the data. An inspection of the means can tell which differences are important. In order to test these, more specific planned comparisons are needed when three or more groups are examined. The research problem or theory can determine the appropriate statistical test (Kerlinger & Lee, 2000). Several examples of post-hoc methods include: Tukey's Honestly Significant Difference (HSD), Fisher's Least Significant Difference (LSD), Student-Newman-Keuls (SNK), Dunnett's Test, Bonferroni's test, and the Scheffe' test.

Tukey's HSD test calculates a new critical value that can be used to evaluate whether differences between any two pairs of means are statistically significant. Fisher's LSD adopts the rationale that if an omnibus test is conducted and significant, the null hypothesis is incorrect. By conducting an omnibus test first, one is screening out group differences that exist due to sampling error and reducing the likelihood for Type I error. Fisher's LSD is criticized, however, for not controlling Type I error. Student-Newman-Keuls conducts pairwise comparisons, but this should only be used with three groups due to the fact that it does not adequately control Type I error. Dunnett's test is similar to Tukey's, but it is used only if a set of comparisons is being made to one group (control), which is rare. Familywise error is the alpha inflation or cumulative Type I error. Bonferroni's test calculates a new pairwise alpha to keep the familywise alpha at .05. Sheffe's method is very conservative and allows for any number of comparisons (Keppel & Wickens, 2004).

The Bonferroni test is probably the most commonly used post hoc test, because it is highly flexible. Although the traditional Bonferroni tends to lack power, several alternatives to the traditional Bonferroni have been created. Olejnik, Li, Supattathum, and Huberty (1997) reviewed modified Bonferroni procedures and concluded that most have clear advantages, but small differences exist among the alternatives in the amount of power or control of Type I error. While post hoc tests are important in actual research, the method of planned comparisons is more important scientifically. When hypotheses are formulated and results support them, it is more powerful evidence than results found after the data is obtained (Kerlinger & Lee, 2000).

For the third research question, a chi-square test was used. Chi-square is a nonparametric statistical test that does not rely on assumptions about the shape of population scores. Chi-square (x^2) is used to determine whether research data in the form of frequency counts are distributed differently for different samples. The frequency counts can be placed into two or more categories (Gall et al., 2003). A single dimension sample will use a chi-square Goodness of Fit Test, and when dealing with multiple dimensions, a chi-square Test of Independence is used. A chi-square statistic is used to investigate whether distributions of categorical variables differ from one another. Actual numbers are used to calculate chi-square. The chi-square statistical procedure allows one to determine when measurements are expressed as categories, whether a difference exists between two groups, between before and after measurements of the same group, or what is expected for a group compared to what is actually observed for the group (Charles & Mertler, 2002). Chi-square tests have been recommended as the most appropriate statistical procedure for analyzing categorical variables that are exclusive, independent, and exhaustive (Rojewski, 2001).

In a chi-square analaysis, two sets of data are compared, observed and expected frequencies. Observed frequencies are the actual frequencies recorded by observation. Expected frequencies are theoretical frequencies that are used for comparison. The chi-square formula is equal to the sum of all $(fo\text{-}fe)^2 / fe$. To determine if the chi-square value is significant, one should consult the table of x^2 values. The first column in this table shows the degrees of freedom involved in the chi-square problem, and the other column represents the values needed for different levels of significance. The number of degrees of freedom is based on the number of observations that are free to vary once restrictions have been placed on the data. The formula for degrees of freedom of a goodness of fit test is equal to K-1, where K is the number of categories used for classification. The formula for degrees of freedom for a test of independence is equal to the number of (rows – 1) multiplied by (columns – 1) (Ary et al., 1972). Degrees of freedom define the latitude of variation contained in a statistical problem (Kerlinger & Lee, 2000).

The level of significance is chosen somewhat arbitrarily, but it is certainly not completely arbitrary. The .05 and .01 levels of significance correspond to two and three standard deviations from the mean of the normal probability distribution. The .05 level of significance has persisted with researchers because it is neither too high nor too low for most social scientific research. When choosing a level of significance, a researcher should determine what level is appropriate for reporting the results (Kerlinger & Lee, 2000). The calculated chi-square value is compared to the critical value from the x^2 table, which is determined by degrees of freedom and level of significance. Based on the comparison, a researcher can determine if there is a statistically significant difference (Charles & Mertler, 2002). A Type I error is rejecting the null hypothesis when it is a correct hypothesis. A Type II error is failing to reject the null hypothesis when it is incorrect (Patten, 2002).

Effect size statistics are useful in determining the practical significance of a study. The higher the effect size the greater the difference between two groups. The measures used, the absolute difference among group means, the shape of the score distribution, the individuals included in the sample, and possibly other factors, affect effect size. There is no simple answer to determining the practical significance of research results. Effect sizes were used as an aid for interpretation (Gall et al., 2003). Tests of statistical significance are inappropriate for making inferences about practical significance of research results. Effect size is one useful technique for assessing the magnitude or practical significance of a difference between the means of two groups.

Effect size takes into account the size of the difference between the means obtained, regardless of statistical significance (Frankel & Wallen, 1996). The higher the effect size the larger the difference between two groups. Effect size alone does not determine practical significance. The magnitude of effect size is affected by the measures used, the absolute difference among group means, the shape of the score distribution, the individuals included in the sample, as well as other possible factors (Gall et al., 2003). When several populations are being compared with the omnibus *F* test, the most common measure of effect size is eta-squared or omega-squared, with values ranging between zero and one, to reflect the proportion of variation in the response variable that is explained by the independent variable (Stevens, 1990). Other researchers prefer to use an index of effect that reports findings that can be translated in terms of measures taken, such as the standardized mean difference. When two populations are compared in this index, the difference between the sample means is divided by the pooled standard deviation. The observed difference between group means is expressed in units of standard deviation. Cohen's *d* is an appropriate effect size measure to use. *d* is defined as the difference between two means divided by the pooled standard deviation for those means where 0.2 is indicative of a small effect, 0.5 a medium and 0.8 a large effect size (Olejnik & Hess, 2003).

CHAPTER 4

DATA ANALYSIS

Introduction

The purpose of this study was to explore outcomes, measured by need for academic remediation and successful completion rates, of tech-prep and non tech-prep students enrolled in postsecondary technical college programs. Specifically, the study addressed three major questions.

1. What are the characteristics of tech-prep and non-tech prep students entering 2-year technical colleges directly from high school in relation to gender, minority status, and type of technical college program pursued?
2. Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school differ in the need for remediation (mathematics, reading, and writing) for the different technical college programs pursued (diploma, technical certificate, and Associate of Applied Science)?
3. Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school have different successful completion rates for each type of technical college program pursued?

This chapter presents findings related to these three research questions.

Descriptive Statistics

Research Question 1: What are the characteristics of tech-prep and non-tech prep students entering 2-year technical colleges directly from high school in relation to gender, minority status, and type of technical college program pursued?

A single population of 173 high school graduates from 2002 and 2003 who entered Coosa Valley Technical College in the 2003 winter, spring, summer, or fall quarters was studied. Fourteen potential participants were removed from analyses due to missing data on either postsecondary program pursued or Asset test scores. Records indicated that 126, or 73% of the total, were classified as tech-prep and 47 (27%) were coded as nontech-prep. Tech-prep students were defined using the local Coosa Valley Tech Prep Consortium definition as high school juniors or seniors that had completed two or more technology or career courses identified in the state database as aligning with a postsecondary program leading to a postsecondary credential (Coosa Valley Area Tech Prep, 2006).

Types of technical college programs included diploma, technical certificate, or Associates degree. In the population studied, 125 (72%) were pursing a diploma, 42 (24%) were pursing a technical certificate, and 6 (4%) were pursing an Associates degree. Minority status was measured as non-minority (white) and minority due to the small enrollment of minority students at Coosa Valley Technical College. The population studied included 156 (90%) non-minority and 17 (10%) minority. There were 83 (48%) females and 90 (52%) males. Frequency results are shown in Table 4.1.

When examining the demographic distribution of the population studied, the majority of students had followed a tech-prep high school curriculum. Gender was evenly distributed. Most students were non-minority and pursued a diploma. A typical student could be a male or female, non-minority who followed a tech-prep high school curriculum, and is pursuing a diploma.

Table 4.1

Demographic Characteristics

Curriculum	Gender		Minority Status		Program Pursued		
	Male	Female	Minority	Non-minority	Diploma	Technical Certificate	Associate of Applied Science
Tech-Prep	70	56	10	116	91	31	4
Non Tech-Prep	20	27	7	40	34	11	2

To determine whether a relationship between gender and high school curriculum participation existed, a chi-square analysis was conducted (see Table 4.2). For the analysis *df* is 1. The observed statistic (.128) is less than the critical value (3.84). Results indicated no statistical differences between gender and tech-prep and non tech-prep students. Therefore, there is no statistically significant relationship between gender and type of high school curriculum completed.

Table 4.2

Cross Tabulation of High School Curriculum and Gender

	Male	%	Female	%	Total
Tech-Prep	70	56	56	44	126
Non Tech-Prep	20	43	27	57	47
Total	90	52	83	48	173

Table 4.3 provides cross-tabulation results for high school curriculum and minority status. Percentages between tech-prep and non tech-prep students in relation to minority are closely related. Also, a chi-square was calculated and results indicated no statistical differences between minority status and tech-prep and non tech-prep students; therefore, minority status does not statistically affect results between tech-prep and non tech-prep students. For the analysis *df* is 1. The observed statistic (.171) is less than the critical value (3.84).

Table 4.3

Cross Tabulation of High School Curriculum and Minority Status

	Minority	%	Non-minority	%	Total
Tech-Prep	10	8	116	92	126
Non Tech-Prep	7	15	40	85	47
Total	17	10	156	90	173

Cross-tabulation results of high school curriculum and technical college program pursued are indicated in Table 4.4. Percentages between tech-prep and non tech-prep students are almost identical when examining type of technical college program pursued. In addition, a chi-square was calculated and results indicated no statistical differences between type of technical college program pursued and tech-prep and non tech-prep students; therefore, type of technical college program pursued does not statistically affect results between tech-prep and non tech-prep students. For the analysis *df* is 2. The observed statistic (.934) is less than the critical value (5.99).

Table 4.4

Cross Tabulation of High School Curriculum and Technical College Program Pursued

	Diploma	%	Technical certificate	%	Associate of applied technology	%	Total
Tech-Prep	91	72	31	25	4	3	126
Non Tech-Prep	34	72	11	24	2	4	47
Total	125	72	42	24	6	4	173

Need for Remediation

Research Question 2: Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school differ in the need for remediation (mathematics, reading, and writing) for the different technical college programs pursued (diploma, technical certificate, and Associate of Applied Science)?

Descriptive statistics for tech-prep and non tech-prep students pursuing a diploma are displayed in Table 4.5. For the numerical Asset test, tech-prep students had a mean score of 38.38 and non tech-prep students had a mean score of 39.50. For the reading Asset test, tech-prep students had a mean score of 40.15, while non tech-prep students had a mean score of 39.26. For the writing Asset test, tech-prep students had a mean score of 39.09 and non tech-prep students had a mean score of 40.85. According to the table, tech-prep students had lower mean scores on the numerical and writing Asset test, but had higher mean scores on the reading test. All mean scores for students pursuing a diploma indicate no need for remedial courses at Coosa Valley Technical College.

ANOVA results for diploma are displayed in Table 4.6. There were no statistically significant differences in numerical or reading Asset test scores between tech-prep and non tech-prep for diploma. However, a statistically significant difference does exist between tech-prep and non tech-prep for writing Asset scores. Specifically, non tech-prep students had a higher mean score on the writing Asset test, but there was a small difference in mean scores between the two groups. The effect size for writing Asset scores is 0.196; therefore, there is a small effect size which indicates that although the results are statistically significant, there is a small practical significance.

Table 4.5

Descriptive Statistics- Asset Test Scores for Diploma

	N	M	SD	SE	Lower bound	Upper bound	Min	Max
Numerical								
Tech-Prep	91	38.38	5.322	.558	37.28	39.49	25	51
Non Tech-Prep	34	39.50	5.017	.860	37.75	41.25	32	50
Total	125	38.69	5.245	.469	37.76	39.62	25	51
Reading								
Tech-Prep	91	40.15	5.064	.531	39.10	41.21	30	51
Non Tech-Prep	34	39.26	5.659	.970	37.29	41.24	29	51
Total	125	39.91	5.224	.467	38.99	40.84	29	51
Writing								
Tech-Prep	91	39.09	4.338	.455	38.18	39.99	27	53
Non Tech-Prep	34	40.85	4.446	.762	39.30	42.40	32	49
Total	125	39.57	4.420	.395	38.79	40.35	27	53

Table 4.6

ANOVA- Asset Test Scores for Diploma

	SS	*df*	MS	F	Sig.
Numerical					
Between Groups	30.794	1	30.794	1.121	.292
Within Groups	3380.038	123	27.480		
Total	3410.832	124			
Reading					
Between Groups	19.568	1	19.568	.715	.399
Within Groups	3364.464	123	27.353		
Total	3384.032	124			
Writing					
Between Groups	77.111	1	77.111	4.044	.047
Within Groups	2345.561	123	19.070		
Total	2422.672	124			

Descriptive statistics for tech-prep and non tech-prep students pursing a technical certificate are displayed in Table 4.7. For the numerical Asset test, tech-prep students had a mean score of 39.29 and non tech-prep students had a mean score of 37.91. For the reading Asset test, tech-prep student had a mean score of 42.03 and non tech-prep students had a mean score of 43.00. For the writing Asset test, tech-prep has a mean score of 41.45 and non tech-prep has a mean score of 39.91.

ANOVA results for technical certificate are displayed in tables 4.8. There were no statistically significant differences in numerical, reading, or writing Asset test scores between tech-prep and non tech-prep students for technical certificate.

Table 4.7

Descriptive Statistics- Asset Test Scores for Technical Certificate

	N	M	SD	SE	Lower bound	Upper bound	Min	Max
Numerical								
Tech-Prep	31	39.29	5.895	1.059	37.13	41.45	29	52
Non Tech-Prep	11	37.91	4.182	1.261	35.10	40.72	33	45
Total	42	38.93	5.483	.846	37.22	40.64	29	52
Reading								
Tech-Prep	31	42.03	5.782	1.038	39.91	44.15	30	53
Non Tech-Prep	11	43.00	5.273	1.590	39.46	46.54	34	53
Total	42	42.29	5.606	.865	40.54	44.03	30	53
Writing								
Tech-Prep	31	41.45	4.048	.727	39.97	42.94	35	53
Non Tech-Prep	11	39.91	3.239	.977	37.73	42.09	34	47
Total	42	41.05	3.876	.598	39.84	42.26	34	53

Table 4.8

ANOVA- Asset Test Scores for Technical Certificate

	SS	*df*	MS	F	Sig.
Numerical					
Between Groups	15.490	1	15.490	.509	.48
Within Groups	1217.296	40	30.432		
Total	1232.786	41			
Reading					
Between Groups	7.604	1	7.604	.237	.629
Within Groups	1280.968	40	32.024		
Total	1288.571	41			
Writing					
Between Groups	19.318	1	19.318	1.295	.262
Within Groups	596.587	40	14.915		
Total	615.905	41			

Descriptive statistics for tech-prep and non tech-prep students pursuing an Associate of Applied Science are displayed in Table 4.9. For the numerical Asset test, tech-prep has a mean score of 39.25 and non tech-prep has a mean score of 47.50. For the reading Asset test, tech-prep has a mean score of 41.50 and non tech-prep has a mean score of 44.50. For the writing Asset test, tech-prep has a mean score of 41.00 and non tech-prep has a mean score of 43.50.

Due to the small sample size no ANOVA statistic was conducted for Associate of Applied Science. By using inferential statistics, the mean scores can be compared. There appear to be no significant differences in the reading and writing Asset test scores between tech-prep and non tech-prep for Associate of Applied Science. Although, for numerical Asset scores, there does appear to be a significant difference between tech-prep and non tech-prep for Associate of Applied Science. Specifically, non tech-prep students had a higher mean score than tech-prep. The effect size for numerical Asset scores was 0.899; therefore, there is a large effect size, which indicates a practical and significant difference in numerical Asset test scores for tech-prep and non tech-prep students pursuing an Associate of Applied Science.

Table 4.9

Descriptive Statistics- Asset Test Scores for Associate of Applied Science

	N	M	SD	SE	Lower bound	Upper bound	Min	Max
Numerical								
Tech-Prep	4	39.25	1.893	.946	36.24	42.26	38	42
Non Tech-Prep	2	47.50	2.121	1.500	28.44	66.56	46	49
Total	6	42.00	4.604	1.880	37.17	46.83	38	49
Reading								
Tech-Prep	4	41.50	7.047	3.524	30.29	52.71	35	49
Non Tech-Prep	2	44.50	2.121	1.500	25.44	63.56	43	46
Total	6	42.50	5.753	2.349	36.46	48.54	35	49
Writing								
Tech-Prep	4	41.00	4.243	2.121	34.25	47.75	38	47
Non Tech-Prep	2	43.50	.707	.500	37.15	49.85	43	44
Total	6	41.83	3.545	1.447	38.11	45.55	38	47

Completion Rates

Research Question 3: Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school have different successful completion rates for each type of technical college program pursued?

Table 4.11 provides a cross-tabulation of high school curriculum, type of technical college program pursued, and successful completion rates. Among students pursuing a diploma, 45 (50%) tech prep students were successful, while 26 (76%) non-tech prep studens were successful. Among students pursuing a technical certificate, tech-prep had 18 (58%) successful and non tech-prep had 8 (73%) successful. Among students pursuing an Associate of Applied Science, tech-prep had 3 (75%) successful and non tech-prep had 2 (100%) successful. Non tech-prep students had higher successful completion rates for diploma, technical certificate, and Associate of Applied Science.

Table 4.10

Cross tabulation of High School Curriculum, Type of Technical College Program Pursued, and Successful Completion Rates

		Successful		Unsuccessful		Total
		n	%	*n*	%	
Diploma	Tech-Prep	45	50	46	50	91
	Non Tech-Prep	26	76	8	24	34
	Total	71	57	54	43	125
Technical certificate	Tech-Prep	18	58	13	42	31
	Non Tech-Prep	8	73	3	27	11
	Total	26	62	16	38	42
Associate of applied science	Tech-Prep	3	75	1	25	4
	Non Tech-Prep	2	100	0	0	2
	Total	5	83	1	17	6

Results of three chi-square tests for each type of technical college program pursued are provided in Table 4.12. For each chi square statistical analysis, *df* was 1. The critical value was 3.84. Each observed result was less than the critical value. For students pursuing a diploma, no statistically significant difference existed. Thus, type of high school curriculum is not related to the successful completion rate for students pursuing a diploma. For technical certificate, the type of high school curriculum does not appear to be related to successful completion rate for technical certificate. Tech-prep and non tech-prep students pursuing a technical certificate do not differ in terms of successful completion. For Associate of Applied Science, the type of high school curriculum does not appear to be related to successful completion rate for Associate of Applied Science. Tech-prep and non tech-prep students pursuing an Associate of Applied Science do not differ in terms of successful completion.

Table 4.11

Chi-Square Test Results

	Chi-square value	df	Asymp. sig. (2-sided)
Diploma	7.365	1	.007
Technical certificate	.740	1	.390
Associate of applied science	.600	1	.439

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Introduction

In past decades, jobs requiring low- to medium-level skills were plentiful and most paid sufficient wages to support a family. Americans with a solid work ethic and some work-related training could fare relatively well in the economy, even if they possessed low academic skills. However, the number of low-skilled positions in the U.S. is declining, and the fastest-growing jobs in the U.S. economy require some form of postsecondary education (D'Amico, 2003). For example, in the U.S. over 65% of all occupations now require advanced skill training beyond high school, but less than a 4-year baccalaureate degree. In addition, 90% of the fastest growing occupations require some career and technical education, many of these are health- or computer-related (U.S. Bureau of Labor Statistics, 2006).

In today's global economy, it is crucial that America's high school students have the sufficient basic skills in English, reading, math, and science, in addition to high-level thinking, reasoning, communication, and problem-solving skills. By the year 2020, jobs that require postsecondary education are expected to increase by 22%, representing an estimated 12 million positions. A large portion of the people filling these positions will require additional education to support the needs of the new diversified workforce. Employers estimate that 39% of high school students entering the labor market are unprepared for entry-level jobs and that almost 60% of jobs in today's workforce require postsecondary training. In Georgia, 40% of ninth grade students drop out of school. Also, about one-fourth of college freshmen drop out of school and one-half of community college students fail to complete a second year of school (Commission for a New Georgia, 2004). These numbers illustrate the fact that changes must be made at the high school level to encourage students to stay in school and obtain basic skills (2005 Education Summit on High Schools, 2005).

In 1990, Congress amended the Carl. D. Perkins Vocational Education Act of 1984 to allocate funding for tech-prep program development. Legislation required that funded programs include the following seven elements: (a) articulation agreements, the effective link between 2-year secondary schools and postsecondary schools; (b) a 2 + 2 design, with a common core of math, science, communication, and technology; (c) a tech-prep curriculum, enriched and applied instruction; (d) joint staff development for secondary and postsecondary faculty; (e) training to promote effective student recruitment, retention, and post-program placement; (f) measures to ensure access for special populations; and (g) preparatory services to include counseling and assessment. Section 343.(3) of the law states:

> The term *tech-prep education program* means "a combined secondary and postsecondary program that A) leads to an associate degree or two-year certificate; B) provides technical preparation in at least one field of engineering technology, applied science, mechanical, industrial or practical art or trade, or agriculture, health or business; C) builds student competence in mathematics, science, and communications (including through applied academics) through a sequential course of study; and D) leads to placement in employment." (Hull & Parnell, 1991, p. 71)

Tech-prep, began in the early 1980s as an effort to improve secondary education for the middle half of students, and has grown into a major national strategy to improve the academic skills and technical knowledge of high school students and to create a better educated and trained workforce. Tech-prep, as defined by the Carl D. Perkins Vocational and Applied Technology Education Act of 1990, focuses on preparing young people to transition directly into the workplace or into higher education upon graduation from high school. The tech-prep curriculum emphasizes competencies needed for an increasingly technological workplace in a sequenced program of studies in which students concentrate on a particular occupation. The curriculum is designed to help students gain academic knowledge and technical skills. Students often earn college credit for secondary coursework. Also, the curriculum provides a foundation for acquiring advanced occupational competencies at the postsecondary level, particularly in associate degree or certificate programs in a specific occupation. Roughly 47% of high schools in the United States offer tech-prep curriculum to students (U.S. Department of Education, 2006).

Tech-prep, according to the Georgia Department of Education (2006), provides high school students with career-related programs of study that are articulated between secondary and postsecondary education and employment. The mission of Georgia tech-prep programs is to provide high school students with an opportunity to participate in a seamless educational system that includes high-level academic and technical preparation for workforce readiness and lifelong learning.

Fifteen years after the initial implementation of tech-prep—through funding provided by the Carl D. Perkins Vocational and Applied Technology Education Act of 1990—the demand for a workforce with academic and career and technical skills is still growing. Tech-prep has been widely effective in creating articulation agreements, developing advanced skills, improving academic achievement through contextual teaching, integrating academic and technical courses, and increasing graduation rates (Hull, 2004). It is still imperative to continuously collect and analyze data to hold tech-prep programs accountable at the local, state, and federal levels. With recent changes to redefine the Perkins legislation through the use of career pathways, tech-prep must demonstrate its contribution to student achievement, program completion, and placement in postsecondary education and the workforce (Hoachlander, 1999).

Past research on outcomes of tech-prep participants has focused primarily on student outcomes at the secondary level (e.g., Atkinson, 1996; Bragg, Layton, & Hammons, 1994; Brown, 2000; Fellers, 1994; Grubb, Badway, Bell, & Kraskouskas, 1996; Hershey, Silverberg, & Owen, 1995; Hershey, Sliverberg, Owen, & Hulsey, 1998; Klimbal, 1996). Student outcomes are typically measured by high school drop-out rates, graduation test scores, grade point averages, attrition rates, Asset test scores, licensure passing rates, or intent to pursue postsecondary education. Much of the research is limited or inconclusive, however, due to poor identification of tech-prep participants.

Oswald (2002) provided evidence that tech-prep participants had higher levels of attendance and were more likely to gain credits toward graduation, but student identification and implementation was an issue. In addition, positive results for tech-prep programs were found in a study by Bragg, Loeb, Gong, Deng, Yoo, and Hill (2002) where tech-prep participants were much more likely to have a vocational concentration and enroll in postsecondary education, but again implementation of the tech-prep model was a factor in the results. Cellini (2005) reported that tech-prep students were more likely to complete high school and attend a two-year college. Most substantial changes in student outcomes have been reported at the secondary level and are less common at the postsecondary level (Grubb, 1995).

Few studies assess the influence of tech prep programs on student outcomes at the postsecondary level. Several studies that do assess postsecondary student outcomes show mixed results. For example, Krile and Parmer (2002) reported that tech-prep programs have a positive effect on student outcomes, while Graham (1996) found that students graduating from a college-prep track achieve at higher levels than students graduating with a tech-prep diploma. Parkhill's (1998) findings suggest that following a tech-prep track does not better prepare students for enrollment in postsecondary education. Bragg et al. (2002) found that a vast majority of postsecondary students, those from both non-tech prep and tech-prep secondary programs, required remedial courses. Also, they found students who had a tech-prep concentration in high school were more likely to enroll in that concentration, but did not enroll with sufficient hours to finish a certificate or degree. Student outcomes in these studies were measured using Asset test scores, grade point averages, and completion rates. Further research was recommended to examine student outcomes and tech-prep program effectiveness on postsecondary education level performance.

Major emphasis has been placed on tech-prep programs during the past decade. The most recent national evaluation of tech-prep programs, conducted in 2004, found data on tech-prep student outcomes to be positive. While students are better prepared for both college and the workplace, tech-prep has not been a widely effective strategy for improving student outcomes at the postsecondary level (U.S. Department of Education, 2006). If tech-prep programs are to maximize the preparation of students for both work and postsecondary education, it is imperative that postsecondary outcomes of high school students graduating from tech-prep programs be examined. Therefore, the purpose of this study was to examine the postsecondary outcomes of tech-prep graduates entering 2-year technical colleges directly from high school after two years of study at the technical college level. Specific measures of student outcomes included indicators of need for mathematics, reading, and writing remediation and successful completion rates from diploma, technical certificate, and Associate of Applied Science Programs.

Tech-prep is a school reform movement aimed at strengthening the academic preparation of students who pursue secondary programs in career and technical education and postsecondary programs in a variety of specific occupational preparation areas which ultimately lead to employment (Cantor, 1999). The idea that students learn more quickly through the integration of academic and vocational skills has been around for centuries. Dewey (1916), in *Democracy in Education,* stressed that education through occupations is more conducive to learning, and, in fact, the integration of vocational and academic curriculum was a major policy objective throughout the twentieth century (Hoachlander, 1999). The concept of integration has been a key strategy for improving teaching and learning in schools (Stasz, Kaganoff, & Eden, 1995). Education through occupations tries to eliminate the unproductive division between academic and vocational courses in school by teaching both theory and application of conventional subjects (Grubb, 1995).

The tech-prep program contains seven essential elements which provide a general template for tech-prep planning and implementation at state and local levels. By understanding the intent of each element, a conceptual schema is assumed where implementation and student outcomes can be assessed (Bragg et al., 2002). Ultimately, Perkins should be judged in terms of outcomes (Stecher, Hanser, Hallmark, Rahn, Levesque, Hoachlander, et al., 1994). The seven elements as defined by Perkins law include:

(1) articulation agreements between secondary and postsecondary consortium participants,

(2) 2+2, 3+2, or a 4+2 design with a common core of proficiency in math, science, communication, and technology,

(3) specifically developed tech-prep curriculum,

(4) joint in-service training of secondary and postsecondary teachers to implement the tech-prep curriculum correctly,

(5) training of counselors to recruit students and to ensure program completion and appropriate employment,

(6) equal access of special populations to the full range of tech-prep programs,

(7) and preparatory services such as recruitment, career and personal counseling, and occupational assessment (U.S. Department of Education, 2006).

Perkins legislation outlines the expected student outcomes of tech-prep which include:

(1) associate degree or a 2-year certificate,

(2) technical preparation in at least one field of engineering, technology, applied science, mechanical, industrial, or practical art or trade, or agriculture, health or business,

(3) competence in math, science, and communication,

(4) and employment (U.S. Department of Education, 2006).

By using the tech-prep program outline as a conceptual framework, it was possible to link tech-prep standards or elements and expected student outcomes. The implementation of Perkins performance measures and standards were judged in terms of student outcomes (Stecher et al., 1994). The tech prep program at the high school level was the foundation for students to reach a student outcome at the post-secondary level. With proper implementation of the tech-prep program, students should have been able to reach outcomes as outlined by Perkins legislation.

Nearly 85 years ago the U.S. government committed to technical education as a national priority. Since then career and technical education has grown to encompass programs such as tech-prep. Nearly half of all high school students are involved in career and technical education as a part of their high school studies (Silverberg, Warner, Fong, & Goodwin, 2004). It is estimated that as many as 40 million adults engage in short-term postsecondary occupational training (Darkenwald & Kim, 1998). Considering the federal commitment to tech-prep and the growing number of participants, this study contributes to our understanding of the impact of tech-prep programs on student outcomes at the technical college level.

With the increased emphasis placed on accountability, it was important to examine tech-prep and measure tech-prep student outcomes. Exploring the postsecondary outcomes of students who completed tech-prep programs in high school provided important information for students, counselors, teachers, and educational administrators at the secondary and postsecondary level. Students can make informed decisions about diploma track, articulation, and career choices. Counselors can better advise students about career and program offerings. Teachers can better understand the level of effectiveness of educational programs, possess knowledge about the academic skills and abilities of students, and modify and enrich the academic base of programs. Administrators are informed on how to make decisions concerning allocation of resources regarding career and technical education. By assessing the student outcomes, it was possible to make improvements in tech-prep and the implementation of tech-prep.

Every worker in the U. S. must develop academic and technical skills to become productive in the labor market. With the growing complex and high tech workplace, it is imperative that students get the skills they need to compete in the economy. As tech prep becomes more widely accepted by educators and the business community, it was important to examine the extent to which tech prep was succeeding at preparing a labor force (Brown, 1998a).

The study assessed tech prep and its impact on student outcomes as they prepare for entry into the labor market. The purpose of this study was to explore outcomes, measured by the need for academic remediation and successful completion rates, of tech-prep and non tech-prep students enrolled in post-secondary technical college programs. Specifically, the study addressed three major questions:

1. What are the characteristics of tech-prep and non-tech prep students entering 2-year technical colleges directly from high school in relation to gender, minority status, and type of technical college program pursued?
2. Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school differ in the need for remediation (mathematics, reading, and writing) for the different technical college programs pursued (diploma, technical certificate, and Associate of Applied Science)?
3. Do tech-prep and non-tech prep students entering 2-year technical colleges directly from high school have different successful completion rates for each type of technical college program pursued?

For each research question, a different statistical procedure was used. For the first question descriptive statistics were used to describe participants' gender, minority status, and type of college program pursued. For the second research question, a series of one-way analysis of variance (ANOVA) procedures were used to compare the two groups of students, tech-prep and non tech-prep. For the third research question, a chi-square test was used.

The sample for this study was 173 high school graduates from 2002 and 2003 who entered Coosa Valley Technical College in the fall, winter, spring, or summer quarters during 2003. Completion status was determined as of December 2005 to give students sufficient time to complete a diploma, technical certificate, or Associates degree.

Findings

When examining the need for remediation, there was a statistically significant difference in tech-prep and non tech-prep writing Asset test scores for students pursuing a diploma. Even so, the difference was small and both scores require no remedial courses at Coosa Valley Technical College. The effect size for writing Asset test scores for the two groups of students pursuing a diploma is 0.196. This indicates a small effect size according to Cohen's d. Students from both groups are prepared for entry into Coosa Valley Technical College. But tech-prep students could be better prepared for entry into the workforce because of their specific skills in a career tech area. Also, they could have gained additional skills and experiences offered as a part of the career tech curriculum.

There was a significant difference in the mean numerical Asset test scores for tech-prep and non tech-prep students pursing an Associate of Applied Science, but the mean score of tech-prep students was 39.25 and the mean score for non tech-prep graduates was 47.50, neither score requires remedial courses at Coosa Valley Technical College. A large effect size of 0.899 indicates that the results are of practical and statistical significance. Although, the results appear to be significant, neither mean score requires remediation for entry in Coosa Valley Technical College.

For diploma, technical certificate, and Associate of Applied Science programs, all mean scores for tech-prep and non-tech prep students did not require remedial courses at Coosa Valley

Technical College; therefore, both groups are prepared for entry into Coosa Valley Technical College. Although both groups are prepared for entry into postsecondary education, tech-prep students could possibly have an advantage for entry into the workforce because of their secondary training in a specific career tech area.

When examining successful completion rates, the type of high school curriculum (tech-prep and non tech-prep) does not appear to be related to the successful completion rate for type of program pursued. Although, non tech-prep students had higher successful completion rates in each program (diploma, technical certificate, and Associate of Applied Science), no significant difference was found.

Conclusions

The purpose of this study was to examine the postsecondary outcomes of tech-prep graduates who had entered 2-year technical colleges directly from high school after two years of study at the technical college level. Specific measures of student outcomes included indicators of need for mathematics, reading, and writing remediation and successful completion rates from diploma, technical certificate, and Associate of Applied Science.

Tech-prep was analyzed in terms of student outcomes as identified by Perkins III. Perkins legislation outlines the expected student outcomes of tech-prep which include associate degree or 2-year certificate, technical preparation in at least one field of engineering, technology, applied science, mechanical, industrial, or practical art or trade, or agriculture, health or business, competence in math, science, and communication, and employment (U.S. Department of Education, 2006).

Of the 173 high school graduates in the study, 73% completed a tech-prep curriculum. The higher enrollment of tech-prep graduates has been noted in past research. In a study by

Bragg et al. (2002), tech-prep participants were much more likely to have a vocational concentration and enroll in postsecondary education. In addition, Cellini (2005) reported that tech-prep students were more likely to complete high school and attend a two-year college. One student outcome, identified by Perkins III, is to enroll in post-secondary education and pursue an associate degree or 2-year certificate.

Tech-prep graduates pursuing a diploma, technical certificate, or Associate of Applied Science program were prepared to enter postsecondary education as indicated by Asset test scores. Tech-prep students were competent in math and communication. Tech-prep graduates differed from non tech-prep graduates only for writing Asset test scores for students pursuing a diploma and numerical Asset test scores for students pursing an Associate of Applied Science, but both tech-prep and non tech-prep students possessed mean scores that meet requirements for entry into postsecondary education. A study conducted by Wallace (1996) indicated that remedial study at the technical college was related to the high school program of students. Tech-prep students required less remediation in reading, writing, and mathematics than students in general education programs. Results of this study, as with Wallace, indicate that tech-prep graduates were prepared for entry into postsecondary education; therefore, their high school curriculum was successful as defined by the Perkins III outcomes.

Findings of the study suggest that a different high school curriculum does not necessarily better prepare students for entry into postsecondary education. Evidence suggests that tech-prep and non tech-prep students are prepared for technical college programs according to Asset test scores, but no other factors were considered in this study. Results from this study show similar and different results as several other research studies that assess postsecondary student outcomes. Graham (1996) found that students graduating from a college-prep track achieve at higher levels than students graduating with a tech-prep diploma. Parkhill's (1998) findings suggest that following a tech-prep track does not better prepare students for enrollment in postsecondary education. Bragg et al. (2002) found that a vast majority of postsecondary students, those from both non-tech prep and tech-prep secondary programs, required remedial courses. In this study, tech-prep and non tech-prep students had mean Asset test scores that did not require remedial courses.

In terms of successful completion rates, findings suggest that tech-prep and non tech-prep students pursing a diploma, technical certificate, or Associate of Applied Science are equally likely to successfully complete a program. According to Perkins legislation, tech-prep and non-tech prep student outcomes do not differ for diploma, technical certificate, or Associate degree. For each type of technical college program, tech-prep students have a 50% or greater completion rate. For this study students were not tracked if they received employment in their technical field before graduation. Tech-prep students may be prepared for employment sooner than non tech-prep students; therefore, they would have completed a successful outcome according to Perkins legislation.

The postsecondary outcomes of tech-prep and non tech-prep graduates for this study do not differ. Both tech-prep and non tech-prep students are prepared for entry into postsecondary education and successful completion rates are similar for each type of technical program pursued. Most substantial changes in student outcomes have been reported at the secondary level and are less common at the postsecondary level (Grubb, 1995). Past research on outcomes of tech-prep participants has been noted on student outcomes, high school drop- out rate, graduation test scores, and grade point averages, at the secondary level (e.g., Atkinson, 1996; Bragg et al., 1994; Brown, 2000; Fellers, 1994; Grubb et al., 1996; Hershey et al., 1995; Hershey et al., 1998; Klimbal, 1996).

Recommendations for Further Research

Based on the findings of this study and current legislation regarding high school curriculum, additional investigations of high school curriculum and student outcomes at the postsecondary level are recommended. Hull (2004) proposed that career pathways were the next generation of tech-prep. Even though tech-prep has been regarded as a separate track in career and technical education, it has been the change agent underlying the conceptualization, design, development, and modeling of innovative improvements in education. *Career pathways* are "a coherent, articulated sequence of rigorous academic and career/technical courses, commencing in the ninth grade and leading to an associate degree, baccalaureate degree and beyond, an industry-recognized certificate, and/or licensure" (p. 6).

Georgia has gone through a tech-prep transformation that includes career pathways. The Georgia State Board of Education has adopted rigorous new graduation requirements for all students. The state's new "Graduation Rule" goes into effect for incoming ninth-graders in 2008 and establishes the state's minimum academic requirements for earning a high school diploma. A hallmark of the new rule is the elimination of tiered diploma requirements. Under the tiered rule there were different expectations for different groups of students, depending on whether they were going to college or the work world. The new rule has one common set of requirements for all students and specifies certain courses that all students must take – making rigorous content an expectation for all, not just some. The elimination of tiers also helps to blur the lines that separated *college prep* from *career tech*. In addition, all students must have a career pathway with a minimum of three courses in the chosen area. The new graduation requirements, along with new state curriculum standards and assessments, will help ensure that more students finish school ready to thrive in the new knowledge-based, high-tech 21st century economy (Georgia Department of Education, 2008).

With increased enrollment in technical colleges and the new Georgia graduation rule, further research must be conducted to examine high school curriculum and post-secondary outcomes. These recommendations for research and practice were based on findings of this study.

1. A replication of this study should be considered which would include all technical colleges in Georgia. In addition to comparing high school curriculum, additional outcomes of Perkins legislation should be examined including employment and technical preparation.
2. A longitudinal study should be conducted to analyze student outcomes of tech-prep students including remediation rates, transfer rates to the University System of Georgia, program completion rates, and employment rates.
3. A comparison study of student outcomes at the post-secondary level during the tech-prep initiative and following the implementation of the new Georgia graduation rule.

Tech-prep is a career and technical education reform movement to prepare students for postsecondary education and the workforce through the use of partnerships, the process of teaching and learning, and an integrated, structured curriculum. Tech-prep has laid a foundation for career pathways and a more rigorous curriculum. The new Georgia graduation rule combines elements of Perkins legislation which lead toward common student outcomes that include less remediation, greater postsecondary completion, and employment.

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APPENDIX

Office of Student Services

Coosa Valley Technical College

706.295.6702 direct
706.295.6944 fax
Floyd County Campus
One Maurice Culberson Drive
Rome, Georgia 30161
www.coosavalleytech.edu

April 18, 2007

To whom it may concern:

Coosa Valley Technical College will act as a cooperating institution for the study conducted by Brittney Wilson through the University of Georgia. The study will examine the outcomes of tech-prep and non tech-prep graduates in postsecondary technical college programs at Coosa Valley Technical College.

The sample for this study will be high-school graduates from 2002-2003 who entered Coosa Valley Technical College in the fall, winter, spring, or summer quarters during 2003. Completion status will be evaluated as of December 2005 which should give students an ample amount of time to complete a diploma, technical certificate, or associate degree. The sample will be chosen due to accessibility, interests, and budget constraints.

Data for the study will be collected after IRB approval from UGA. Anticipated data collection date is September 2007. Data to be collected will include information already compiled while participants were in their first two years at Coosa Valley Technical College. Specific data collected to reflect outcomes will include ASSET scores and completion rates. In addition, descriptive data will be collected that includes high school curriculum (tech prep or non-tech prep), gender, minority status, and technical college program pursued. Data will be collected from databases managed by Coosa Valley Technical College.

Confidentiality for the study will be maintained. No identifying factors of participants are needed for completion of this study. Only access to data listed above will be collected and analyzed.

Thanks,

Steve Bradshaw, Ed.D.
Coosa Valley Technical College
Vice President, Student Services